



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

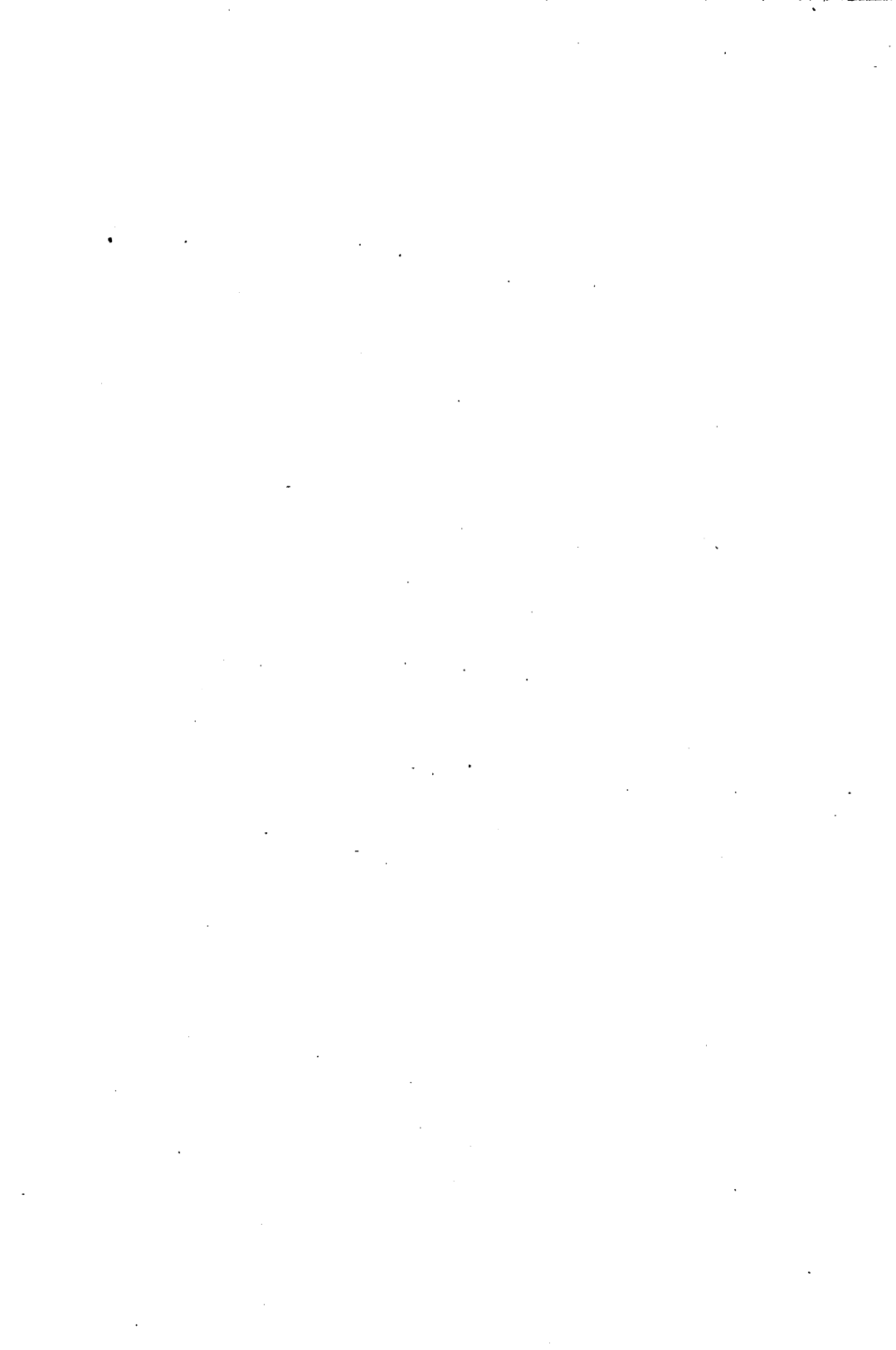
We also ask that you:

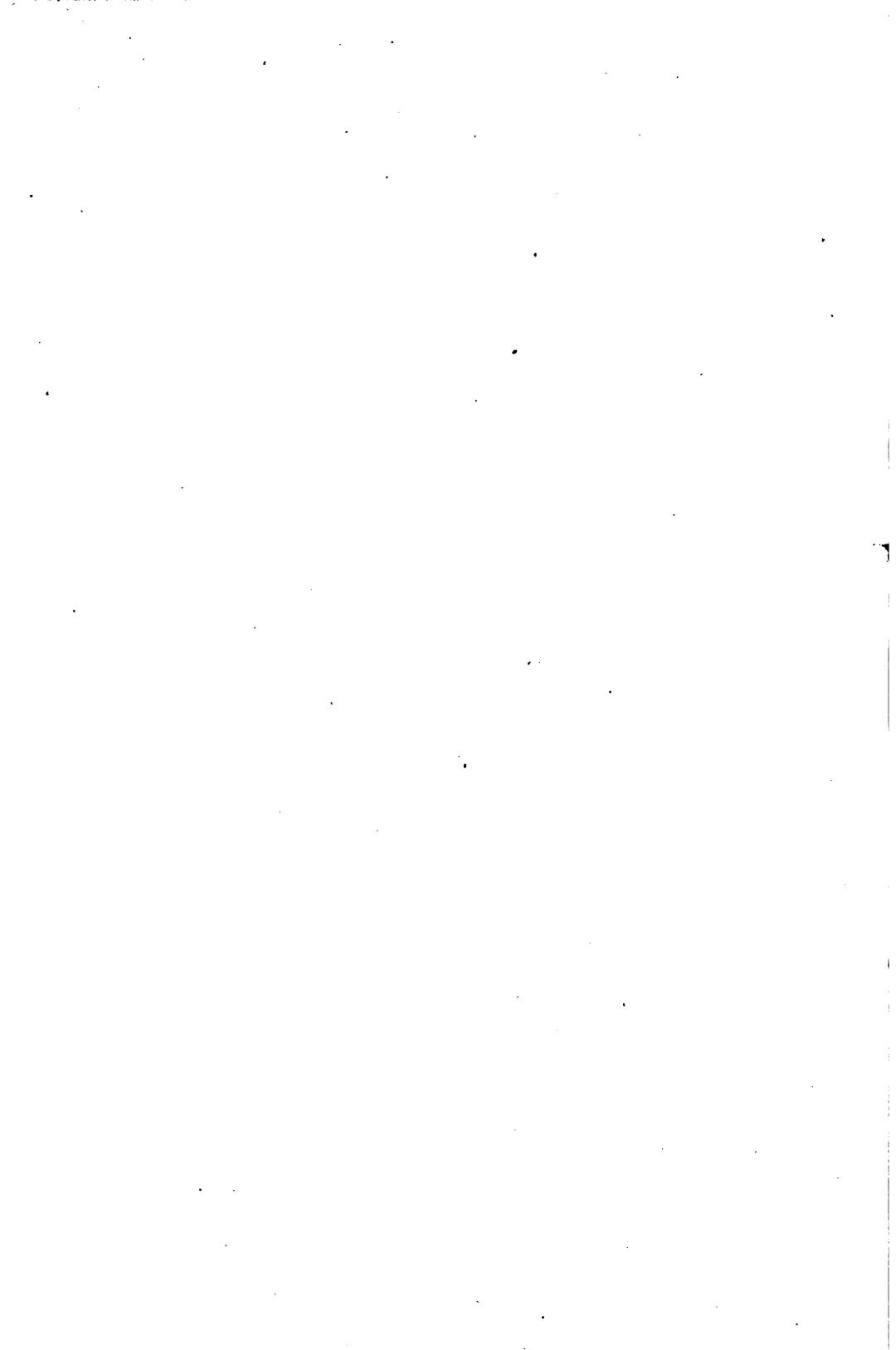
- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

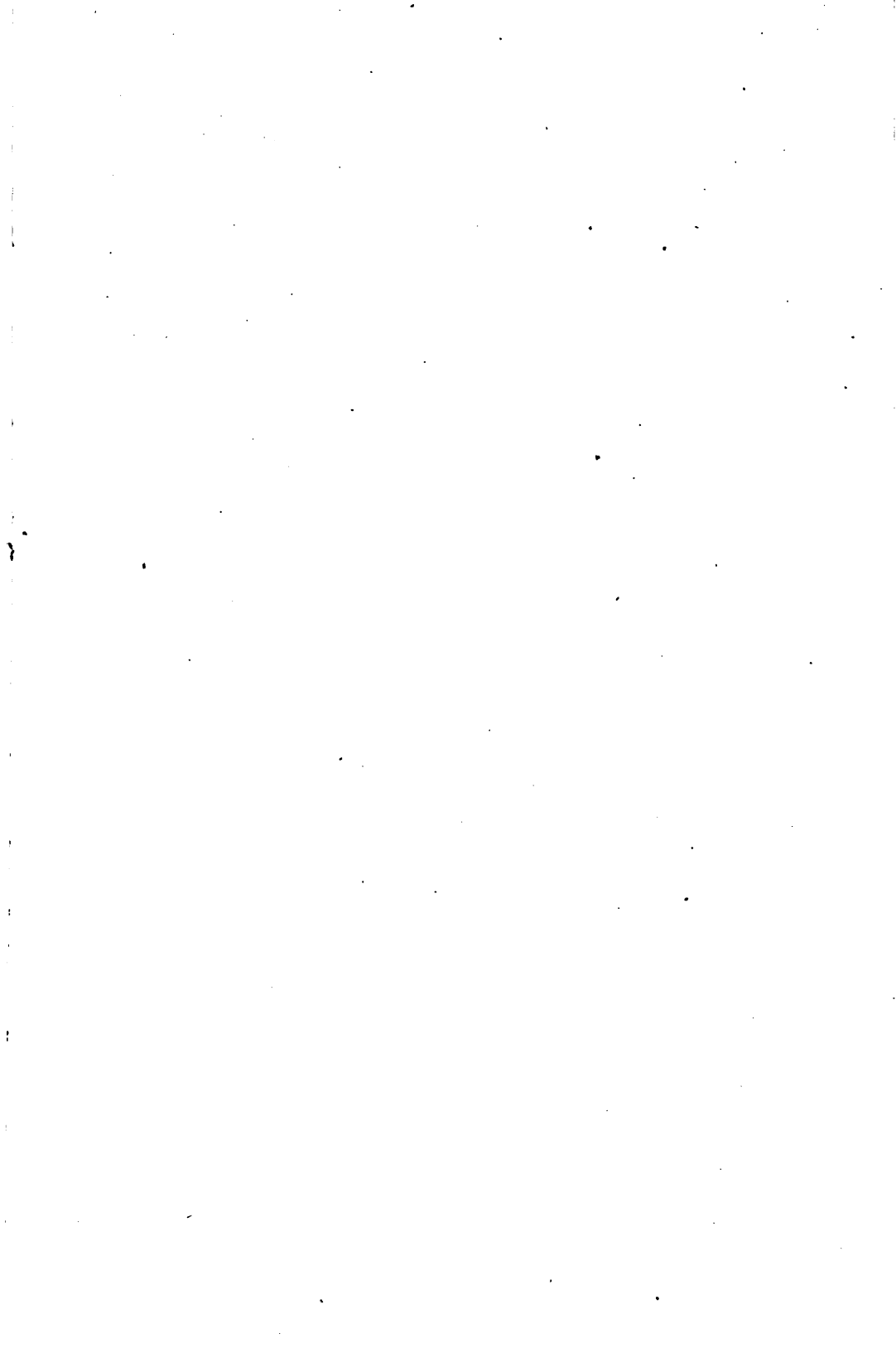
About Google Book Search

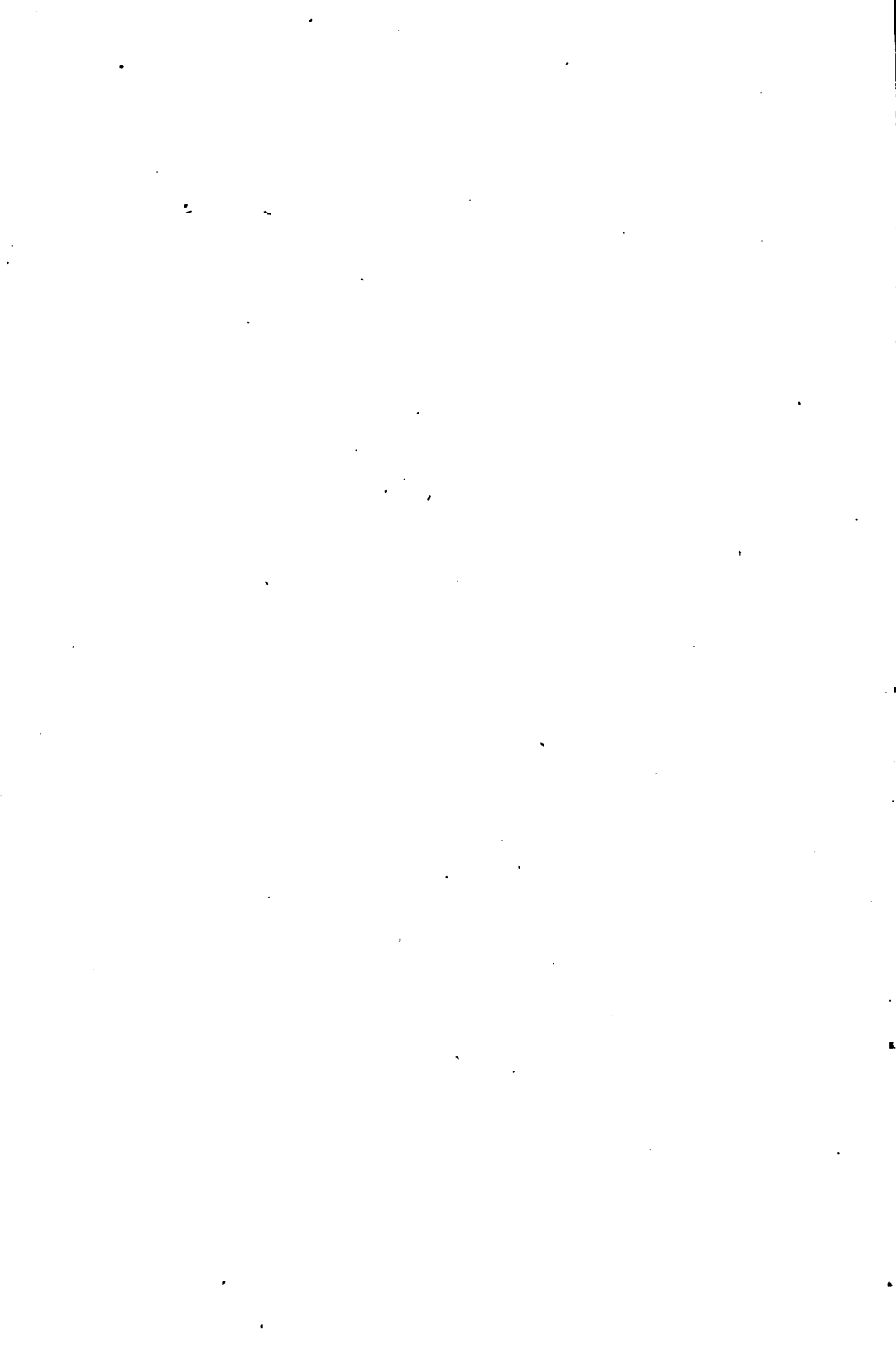
Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>











OFFICIAL DOCUMENTS
AND
OTHER INFORMATION
RELATING TO THE
IMPROVEMENT
OF THE
SHIP CHANNEL
BETWEEN
MONTREAL AND QUEBEC.



Montreal, Board of Harbour Commissioners.
" "

Commissioners :

ANDREW ROBERTSON, Esq., CHAIRMAN.

I. B. ROLLAND, Esq.

HUGH McLENNAN, Esq.

EDWARD MURPHY, Esq.

CHARLES H. GOULD, Esq.

HENRY BULMER, Esq.

HON. J. L. BEAUDRY (MAYOR.)

VICTOR HUDON, Esq.

ANDREW ALLAN, Esq.

H. D. WHITNEY, SECRETARY.

Montreal :

PUBLISHED BY ORDER OF THE HARBOUR COMMISSIONERS OF MONTREAL.

1884.

206

GAZETTE PRINTING COMPANY, MONTREAL.

INTRODUCTION.

The object in collecting and publishing the following documents and notes is to place before the public a connected account of the improvements in the ship channel of the St. Lawrence between Montreal and Quebec from the first attempts up to the present day. An endeavour has been made to give the facts as much as practicable in detail, with but little comment, further than that necessarily made in introducing the several documents. These have been placed in the order of time, except in cases where the sense or continuity is better preserved by a slight variation. The principal sources from which information has been obtained are the Library of Parliament at Ottawa, printed reports of the Harbour Commissioners and printed correspondence, all of which no doubt are fully reliable. All the information obtainable and directly connected with the improvements from their beginning up to the year 1850 is given in detail, as it is of great interest, and is not conveniently within the reach of the general public, being scattered through the journals of the Legislative Assembly of Lower Canada previously to 1841, and subsequently through the records of the Parliaments of the United Canadas. After the year 1850, at which date the Harbour Commissioners of Montreal were invested with the execution of the work, the information obtainable is fuller and better connected, being embodied in their reports and in the reports of the Department of Public Works. Of the period from 1850 to 1865, when the depth of 20 feet was attained, the account given here is not so much in detail as in the earlier stages, but sufficiently so to convey a clear account of the progress of the work. Since the renewal of operations in 1874, the work has been conducted on a much more extensive scale than formerly, and full reports, which may be obtained easily, have been issued annually. On this account, and in order to restrict the size of this pamphlet, only the main events in the history of the improvements since that time are given.

There are many points of interest relating to the ship channel here sketched. There is an interest peculiar to it as being the great water-way of the country, the great ocean highway of the Dominion, the natural route to Europe for three-quarters of the Continent of North America. Its existence goes back into the past far enough to give it an historical interest, while it is a matter of greater importance in the present day than at any former period. The men who were active in the first attempt to improve the St. Lawrence ship channel in 1825 have probably all passed away, and personal memories of them no longer exist, except, perhaps, with a few of our oldest citizens, but many of our older men remember well those who have been connected with the available improvements since they were actually begun in 1851, and some of these have lived almost to the present time. One deserving special mention is the late Hon. John Young, who was a Harbour Commissioner from 1850 until his decease, in 1878, with the exception of three years, being for twenty-five years a member and thirteen years Chairman of the Board, and who, for a lifetime, devoted enthusiastic energy and unslacking perseverance to the advancement of the St. Lawrence navigation. Others scarcely less prominently connected with the works deserve the gratitude of the country for the active part they have taken, and still take in developing its shipping interests and the noble river that bears its commerce to the sea. As a great engineering work the St. Lawrence ship channel has special interest. When first undertaken it was considered, of its kind, a work of unusual magnitude, and it is still quoted as one of the great dredging works of the world. Though not the birthplace of dredges, the St. Lawrence ship channel takes a first place among the works, where great improvements have been applied to dredges and methods of dredging, which have resulted in their present efficiency and development. In 1846 the Board of Works reported the performance of a dredge "most satisfactory," when raising 1,160 cubic yards per day in Lake St. Peter, from a depth of 10 feet, but continued improvements have brought the present dredges to a daily capacity of 3,000 or 4,000 yards in Lake St. Peter clay, and 600 or 700 yards in unblasted shale rock at 25 or 30 feet depth. The dredges used have been almost exclusively of the kind known as ladder dredges, with an endless chain of

buckets, and it is the only instance on the Continent where such dredges have been systematically used on a work of any magnitude. It is claimed that here radius dredging was originated, without which it would be almost impracticable to dredge with precision over large areas in wide rivers and lakes. It is also of special interest to note, that unlike most river works, the St. Lawrence ship channel costs nothing for maintenance. From the great lakes the pure water passes through the rocky channels of the Thousand Islands and the several rapids that lead to Montreal. Thence the river flows with a gentle current, bearing no detritus, and the artificial deepening when once made, remains permanent, without either silting up or scouring out of shape.

But the point of most vital importance in connection with the St. Lawrence Ship channel is its national character. It will be seen, in reading its history, that from the first attempts to improve it in 1825, its national character has been recognised. In the year 1826, the improvement of the ship channel between Montreal and Quebec was taken up as a matter of public importance by the Legislative Assembly of Lower Canada. The committee appointed to investigate the matter, having procured plans of Lake St. Peter and examined a number of witnesses, reported that the importance of the subject required that further information should be obtained. In the next year the subject was again discussed, and a committee appointed to make further investigations. The need of a thorough survey was felt, and in view of the fact that the Admiralty survey of the St. Lawrence was then in progress, and would soon reach Lake St. Peter, further inquiry was deferred, until a report of the Admiralty survey could be obtained. In compliance with the request which had been made by Sir James Kempt, Captain Bayfield, having made this survey, submitted his observations on the nature of the lake, its channels, &c., in May, 1831. This report, accompanying a message from Lord Aylmer, Governor-in-Chief, was transmitted to the House in December, 1831, and referred to a committee of five members to report on the same. No action immediately followed, however, and again in 1836 the matter was discussed and evidence taken before the Standing Committee of Trade. The Admiralty chart of the lake had not yet been received, and this seems to

have delayed further action, for on 5th May, 1838, an ordinance was passed granting £500 for the purpose of making a survey of Lake St. Peter. Nothing official is recorded of what followed this grant until 1841, when Secretary Daly, regarding the petition of the Board of Trade, writes to the chairman of the Select Committee that "His Excellency has commanded me to inform you that the *improvement of the navigation of Lake St. Peter* will be considered with *other public works*." An extensive investigation was made by a special committee of the House, in August, 1841, into the "extent of the burden imposed on the trade by the obstructions to the navigation which it is sought to remove," and an estimate of the cost of deepening the channel in the lake to sixteen feet deep at low water, was made by David Thompson, C.E. The result of the investigation was the recommendation by the special committee of the House "that measures may be taken to deepen the ship channel in Lake St. Peter." During this investigation the committee discussed the proposal of a tonnage duty on the shipping coming up to Montreal, but while they believed that a tonnage duty, sufficient to provide for the cost of deepening the channel, would be much less burdensome to the trade than the cost for lighterage then was, yet they deemed that "*in order to draw the produce of the west down the St. Lawrence it is expedient to make the transit charges as light as possible*," thus clearly recognising the national character of the St. Lawrence ship channel. Action was taken on the recommendation of the report, and an appropriation was inserted among the estimates for the prosecution of the work, which was styled in the report of the Board of Works, for 1841, *a subject of very great importance*.

The expediency of the work being now decided, a question arose as to the best location for the channel in Lake St. Peter. Chas. Atherton, C.E., reported in favour of deepening the natural channel then used in the lake, but his advice was not followed, and work was begun in the "straight" or "Board of Works" channel, in the spring of 1844. But many of those who were the strongest advocates of the proposed improvements, objected to this location, maintaining that the desired object could be attained sooner, more effectually, and at a less cost, by deepening the natural channel. This opposition to the straight channel increased during the progress of the work, and caused its tempo-

rary suspension in the summer of 1846, and its final suspension in the fall of 1847.

Discussions and investigations continued until 1850, when the Harbour Commissioners of Montreal proposed a plan for the accomplishment of the work, believing that they could execute it successfully, by methods more economical and expeditious than had been adopted by the Board of Works. They proposed "That the Harbour Commissioners of Montreal should be authorized to undertake the work, and to borrow money, the interest of which should not exceed eight per cent., and this interest, as well as a sinking fund of two per cent., was to be provided for by a tonnage duty, not exceeding one shilling per ton register, on all vessels drawing ten feet and upwards, for each time they passed through the lake, and should the revenue so collected prove insufficient to pay the interest on moneys borrowed, the surplus revenues of the Harbour of Montreal were to be applied to make up any deficiency. This plan was adopted by Government, and an Act of Parliament procured in accordance with it," (viz., Act 13 and 14 Vic., cap. 97, passed August, 1850), authorizing the Commissioners to borrow £30,000 for the purpose of proceeding with the works "in such a manner, direction, and place as the Commissioners should deem best." Thus far the work had been carried on with dredging plant belonging to Government, under the direct supervision of Government officers, and the plant was now transferred to the Harbour Commissioners for continuing the work.

The Commissioners forthwith appointed a Board of Engineers, to inquire into and report on the best means of obtaining a channel of sixteen feet depth through Lake St. Peter. After inquiring into the state and nature of the two channels, these Engineers reported in favour of abandoning the straight channel and of applying the work of improvement to the old or natural channel. The Harbour Commissioners adopted their recommendation and began operations in the old or natural channel in June, 1851. Early and continued success accompanied their efforts, and a rapid increase of shipping attended the available improvements of the channel. By November, 1851, the natural channel in the lake, of about 10 feet 6 inches at low water was deepened two feet. In August, 1853, a vessel passed through the dredged

channel from Montreal to the foot of Lake St. Peter, drawing four feet more than the original depth of water. In 1855, sixteen and a half feet depth at low water was attained, and eighteen feet depth was accomplished in 1857. These results were re-assuring and demonstrated the feasibility of obtaining a channel of the required depth up to the entrance of the Lachine Canal, the natural junction of the ocean and inland shipping of the country. The Harbour Commissioners now represented to the Government the national character of the work, urging that the benefits derived from the improvements in the channel are not confined to Montreal, but extend to the whole of the country lying to the westward, and prayed that the revenue of the harbour of Montreal might be relieved of the burden unjustly laid upon it. John Page, C.E., then Chief Engineer of Public Works, in his report on the ship channel, dated January 25th, 1869, referring to this matter says—"These views having been repeatedly brought before the Government, after a full discussion of the question, it was decided in 1860 that the river improvements should henceforth be considered as public works."

Thus it is clear that in 1860 the deepening of the ship channel between Montreal and Quebec was recognised and acknowledged to be a public work, and so continued to be considered, in as much as in 1866, almost the entire debt of the twenty-foot channel was assumed and paid by the Government. The further deepening, has been carried on by the Harbour Commissioners, under the authority of the Dominion Government, with funds provided by the sale of Government debentures, the interest on which is paid out of the harbour dues.

The decided success which attended the earlier operations of the Harbour Commissioners in the ship channel has been even surpassed by their recent achievements. Through improvements applied to the dredges their efficiency has been greatly increased, both in expediting the work and lessening its cost. In 1878 a depth of twenty-two feet in the channel was attained. The cost of dredging in Lake St. Peter was reduced, in 1881, to 3½ cents per cubic yard. The work of obtaining a channel of twenty-five feet depth was accomplished in 1882, and the further deepening to 27½ feet at low water is now in full progress, and will be effected in 1887.

At pages 337-8 will be found the total amount expended to secure a depth of 25 feet at low water in the ship channel, and the amount of excavation involved, showing the cheapness of the work done. At page 332 to 334 will be found tables of comparative distances showing the advantage, in point of distance, of the St. Lawrence route over all other routes between the West and Europe. Ere many years two vast trans-continental railway systems, traversing the richest wheat raising areas in the world, will be direct tributaries to the St. Lawrence route, besides other railway systems scarcely less extensive, and as the development of the North-West and West advances, the public benefits derived from the St. Lawrence ship channel improvements must become more apparent to all, and receive the public recognition they deserve.

HARBOUR COMMISSIONERS' OFFICE, }
Montreal, October, 1884. }

ORIGIN AND APPOINTMENT

OF THE

HARBOUR COMMISSIONERS OF MONTREAL.

The existence of the Harbour Trust dates back to the year 1830, when an act was passed giving power to the Governor to appoint three Commissioners for the purpose of carrying into effect an act providing for improvements in the Harbour of Montreal. The first appointment of Commissioners seems to have been merely for the purpose of carrying into effect that act, but as new improvements were proposed from time to time, the Commissioners were retained for the purpose of executing them. In 1841 an act was passed giving the Governor power, when he should deem it expedient, to appoint additional Harbour Commissioners, but it does not appear that such additional Commissioners were appointed, as there were only three up to the year 1855. Up to the year 1850 the works executed by the Harbour Trust were confined to the Harbour of Montreal, but in 1850 an act was passed authorizing the Commissioners to borrow money for improving Lake St. Peter and the channel at *Ile Platte*, and the improvements in the ship channel since that time have been executed by the Harbour Commissioners. In 1855 an act was passed which provided that after the 1st of July, 1855, the Board of Harbour Commissioners should consist of five members, three to be appointed by the Crown, the other two members, for the time being, to be the Mayor of the City of Montreal and the President of the Board of Trade. The Board remained thus constituted until May, 1873, when an act was assented to providing that after the first day of October of that year the corporation should consist of nine members, four of whom should be appointed by the Government, five to be elected, and to be eligible for re-election for terms of five years, as follows: two by the Montreal Board of Trade, one by the Corn Exchange Association, one by

the Montreal City Council, and one by the shipping interest. In May, 1874, this act was amended, whereby one of the two members elected by the Board of Trade ceased to be a member of the Board of Harbour Commissioners after the first day of August of that year, and thereafter five of the nine members were to be appointed by the Government, the other four to be elected according to the act of 1873, but the terms of the representatives were reduced to four years, all, however, to be eligible for re-election on the expiration of their respective terms. The Board of Harbour Commissioners remains thus constituted to the present time (1884).

LIST OF HARBOUR COMMISSIONERS OF MONTREAL,
and the dates when they were Members of the Board, from
its establishment in 1830 up to the present time (1884.)

Hon. George Moffat	1830 to 1836.
Jules Quesnel.....	1830 " 1836.
Capt. Robert S. Piper.....	1830 " 1836.
P. L. Letourneux.....	1836 " 1839.
Thos. Cringan	1836 " 1840.
Turton Penn.....	1836 " 1840.
Wm. Lunn	1839 " 1840.
J. G. Mackenzie.....	1840 " 1850.
John Try	1840 " 1855.
C. S. Rodier	{ 1840 " 1850.
	{ 1859 " 1862.
Hon. John Young.....	{ 1850 " 1866.
	{ 1870 " 1872.
	{ 1873 " 1878.
Louis Marchand	1850 " 1855.
H. H. Whitney	1855 " 1863.
Sir George E. Cartier.....	1855 " 1858.
Dr. Nelson	1855 " 1856.
Hon. H. Starnes	{ 1855 " 1857.
	{ 1866 " 1871.
Hon. L. H. Holton.....	{ 1856 " 1859.
	{ 1862 " 1863.
J. A. Berthelot	1858 " 1859.
Thos. Kay	1859 " 1860.
A. M. Delisle	{ 1859 " 1864.
	{ 1866 " 1874.
Thos. Cramp	{ 1860 " 1861.
	{ 1863 " 1866.
	{ 1874 " 1879.
E. Atwater.....	1861 " 1862.

Hon. J. L. Beaudry	{	1862 to 1866.
		1877 " 1879.
		1881. On present Board.
Henry Lyman		1863 " 1864.
John Pratt.....	{	1864 " 1866.
		1874 " 1876.
Peter Redpath.....		1864 " 1865.
J. H. Winn.....	{	1865 " 1866.
		1869 " 1870.
John McLennan		1866 " 1867.
Geo. Stephen		1866 " 1873.
Wm. Workman		1866 " 1874.
Thomas Rimmer.....		1867 " 1869.
C. J. Coursol		1871 " 1873.
Hugh McLennan.....		1872. On present Board.
Dr. A. Bernard		1873 " 1876.
Victor Hudon	{	1873 " 1874.
		1879. On present Board.
M. P. Ryan		1873 " 1874.
Andrew Allan		1873. On present Board.
W. W. Ogilvie.....		1873 " 1875.
Peter Donovan		1874 " 1879.
Adolphe Roy		1874 " 1879.
Chs. H. Gould		1875. On present Board.
Dr. W. H. Hingston.....		1876 " 1877.
Hon. J. R. Thibaudeau		1876 " 1877.
Edward Mackay		1878 " 1879.
S. Rivard		1879 " 1881.
Andrew Robertson		1879. On present Board.
J. B. Rolland		1879. "
Edward Murphy.....		1879. "
Henry Bulmer.....		1879. "

The following is a list of the Boards of Harbour Commissioners that have executed the duties of the Trust from 1830 up to the present time (1884), showing the interest represented by each member :—

* Indicates the Chairman of the Board.

(c)	"	"	representative of the Corn Exchange.
(t)	"	"	" " Board of Trade of Montreal.
(m)	"	"	" " City of Montreal.
(s)	"	"	" " Shipping interest.

The members not indicated as representatives of the Corn Exchange, Board of Trade, City of Montreal or Shipping interest have been appointed by the Government of their time.

1830 to 1836.

Hon. George Moffatt,*
Jules Quesnel, Esq.
Capt. Robert S. Piper.

1836 to 1839.

P. L. Letourneau, Esq.
Thomas Cringan, Esq.
Turton Penn, Esq. *

1839 to 1840.

Turton Penn, Esq.*
Thomas Cringan, Esq.
William Lunn, Esq.

1840 to 1850.

J. G. Mackenzie, Esq.*
John Try, Esq.
C. S. Rodier, Esq.

1850 to 1855.

John Try, Esq.,*
Hon. John Young,* from 1853,
Louis Marchand, Esq.

1855 to 1856.

Hon. John Young,*
H. H. Whitney, Esq.
Sir George E. Cartier,
Dr. Nelson, (m)
Hon. H. Starnes. (t)

1856 to 1858.

Hon. John Young,*
H. H. Whitney, Esq.,* Chairman
pro tem.
Sir George E. Cartier,
Hon. H. Starnes, (m)
Hon. L. H. Holton. (t)

1858 to 1859.

Hon. John Young,*
H. H. Whitney, Esq.
Sir George E. Cartier,
Hon. L. H. Holton, (t)
J. A. Berthelot, Esq. (m)

1859 to 1860.

C. S. Rodier, Esq., (m)
Hon. John Young,
H. H. Whitney, Esq.*
Thomas Kay, Esq. (t)
A. M. Delisle, Esq.

1860 to 1861.

C. S. Rodier, Esq. (m)
Hon. John Young,
H. H. Whitney, Esq.*
A. M. Delisle, Esq.
Thomas Cramp, Esq. (t)

1861 to 1862.

C. S. Rodier, Esq., (m)
Hon. John Young,* Chairman *pro tem* in 1862,

1861 to 1862—Continued.

H. H. Whitney, Esq.*
A. M. Delisle, Esq.,
E. Atwater, Esq. (t)

1862 to 1863.

Hon. John Young,
H. H. Whitney, Esq.*
Hon. L. H. Holton, (t)
A. M. Delisle, Esq.
Hon. J. L. Beaudry, (m)

1863 to 1864.

Hon. John Young,*
A. M. Delisle, Esq.
Thomas Cramp, Esq. (t)
Hon. J. L. Beaudry, (m)
Henry Lyman, Esq. (t)

1864 to 1865.

Hon. John Young,*
Thomas Cramp, Esq.
Hon. J. L. Beaudry, (m)
John Pratt, Esq.
P. Redpath, Esq., (t)

1865 to 1866.

Hon. John Young,*
Thomas Cramp, Esq.
Hon. J. L. Beaudry, (m)
John Pratt, Esq.
J. H. Winn, Esq., (t)

1866 to 1867.

Hon. H. Starnes, (m)
A. M. Delisle, Esq.*
J. McLennan, Esq. (t)
George Stephen, Esq.
William Workman, Esq.

1867 to 1869.

Hon. H. Starnes, (m)
A. M. Delisle, Esq.*
George Stephen, Esq.
William Workman, Esq.
Thomas Rimmer, Esq. (t)

1869 to 1870.

Hon. H. Starnes, (m)
A. M. Delisle, Esq.*
J. H. Winn, Esq. (t)
George Stephen, Esq.
William Workman, Esq.

1870 to 1871.

Hon. John Young, (t)
Hon. H. Starnes, (m)
A. M. Delisle, Esq.*
George Stephen, Esq.
William Workman, Esq.

1871 to 1872.

Hon. John Young, (t)
A. M. Delisle, Esq.
George Stephen, Esq.
William Workman, Esq.
C. J. Coursol, Esq. (m)

1872 to 1873.

A. M. Delisle, Esq.*
George Stephen, Esq.
William Workman, Esq.
C. J. Coursol, Esq. (m)
Hugh McLennan, Esq. (t)

1873 to 1874.

Hon. John Young,*
A. M. Delisle,
William Workman, Esq.
Hugh McLennan, Esq. (t)
Dr. Bernard, (m)
Victor Hudon, Esq.
M. P. Ryan, Esq.
Andrew Allan, Esq. (s)
W. W. Ogilvy, Esq. (c)

1874 to 1875.

Hon. John Young,*
Thomas Cramp, Esq.
John Pratt, Esq.
Hugh McLennan, Esq. (t)
Dr. Bernard, (m)
Andrew Allan, Esq. (s)
W. W. Ogilvie, Esq. (c)
Peter Donovan, Esq.
Adolphe Roy, Esq.

1875 to 1876.

Hon. John Young,*
Thomas Cramp, Esq.
John Pratt, Esq.
Hugh McLennan, Esq. (t)
Dr. Bernard, (m)
Andrew Allan, Esq. (s)
Peter Donovan, Esq.
Adolphe Roy, Esq.
Charles H. Gould, Esq. (c)

1876 to 1877.

Hon. John Young,*
 Thomas Cramp, Esq.
 Hugh McLennan, Esq. (t)
 Andrew Allan, Esq. (s)
 Peter Donovan, Esq.
 Adolphe Roy, Esq.
 Charles H. Gould, Esq. (c)
 Dr. W. H. Hingston, (m)
 Hon. J. R. Thibaudeau.

1877 to 1878.

Hon. John Young,*
 Thomas Cramp, Esq.,* *pro tem* 1877
 Hon. J. L. Beaudry, (m)
 Hugh McLennan, Esq. (t)
 Andrew Allan, Esq. (s)
 Peter Donovan, Esq.
 Adolphe Roy, Esq.
 Charles H. Gould, Esq. (c)
 Hon. J. R. Thibaudeau,

1878 to 1879.

Thomas Cramp, Esq.*
 Hon. J. L. Beaudry, (m)
 Hugh McLennan, Esq. (t)
 Andrew Allan, Esq. (s)
 Peter Donovan, Esq.

1878 to 1879—Continued.

Adolphe Roy, Esq.
 Charles H. Gould, Esq. (c)
 Hon. J. R. Thibaudeau,
 Edward Mackay, Esq.

1879 to 1881.

Hugh McLennan, Esq. (t)
 Victor Hudon, Esq.
 Andrew Allan, Esq. (s)
 Charles H. Gould, Esq. (c)
 S. Rivard, Esq. (m)
 Andrew Robertson, Esq.*
 J. B. Rolland, Esq.
 Edward Murphy, Esq.
 Henry Bulmer, Esq.

1881 to present time (1884).

Hon. J. L. Beaudry, (m)
 Hugh McLennan, Esq., (t)
 Victor Hudon, Esq.
 Andrew Allan, Esq. (s)
 Charles H. Gould, Esq. (c)
 Andrew Robertson, Esq.*
 J. B. Rolland, Esq.
 Edward Murphy, Esq.
 Henry Bulmer, Esq.,* *Chairman pro tem* in 1880.

List of Secretaries of the Board of Harbour Commissioners of Montreal, from its establishment in 1830 up to the present time (1884):—

Frederick Griffin, May, 1830, to May, 1831.
 Nicholas Charles Radiger, May, 1831, to April, 1837.
 W. Badgley, April, 1837, to January, 1838.
 Francis Badgley, January, 1838, to July, 1841.
 John F. Badgley, July, 1841, to February, 1852.
 John Glass, February, 1852, to October, 1855.
 Alexander Clerk, October, 1855, to May, 1863.
 H. H. Whitney, May, 1863, to January, 1877.
 H. D. Whitney, January, 1877, to present time (1884).

List of Engineers and Superintendents in charge of the deepening of the Ship Channel between Montreal and Quebec, or otherwise prominently connected with the execution of the work up to the present time (1884):—

Captain Henry W. Bayfield, R.N., in charge of the Admiralty Survey of the River and Gulf of St. Lawrence, made several special reports in connection with the deepening of Lake St. Peter.

David Thompson, Esq., C.E., made survey and estimate for deepening channel in 1841.

Charles Atherton, Esq., Civil Engineer in charge of the surveys and investigations made in Lake St. Peter, in 1842-3.

F. P. Rubidge, Esq., Civil Engineer in charge of surveys, investigations, &c., in Lake St. Peter, in 1847.

C. S. Gzowski, Esq., C.E., Engineer of the Harbour Works and Consulting Engineer to the Ship Channel Improvements, 1851 to 1853.

T. C. Keefer, Esq., C.E., do. do., 1853 to 1855.

Robert Forsyth, Esq., C.E., do. do., 1855 to 1864.

A. G. Nish, Esq., C.E., do. do., 1864 to 1875.

John Kennedy, Esq., C.E., M.I.C.E., Chief Engineer of the Harbour Works and the Ship Channel Improvements, 1875 to present time (1884).

Captain Vaughan, Superintendent of Dredging, 1844 to 1846.

“ Bell, “ “ 1851 to 1856.

Robert Forsyth, Esq., C.E., “ Nov., 1856, to April, 1857.

Captain C. L. Armstrong, “ 1857 to '67, and in 1874-5.

“ Thomas McKenzie, “ 1876 to 1883.

James Howden, Esq., “ 1883 to present time (1884).

IMPROVEMENT
OF THE
SHIP CHANNEL
BETWEEN
MONTREAL AND QUEBEC.

The earliest agitation to improve the ship channel in the River St. Lawrence appears to have been made about the year 1825. On the 13th of February, 1826, a petition from the merchants of Montreal was read before the Legislative Assembly of Lower Canada, as shown by the following extracts from the journals of the Legislative Assembly of Lower Canada :—

MONDAY 13th February, 1826.

Mr. Leslie read in his place a Petition of the Committee of Merchants at Montreal, whose names are thereunto subscribed.

After which, Mr. Leslie informed the House that His Excellency the Governor-in-chief, being acquainted with the purport of the said Petition, gives his consent that the House may proceed thereon as they shall think fit.

And then the said Petition was received and read ; setting forth, that the extraordinary efforts making in Great Britain and in the United States of America for the promotion of every improvement calculated to advance the objects of Commerce, naturally excite in the minds of the inhabitants of this province corresponding sentiments in regard to the means of advancing the trade

and drawing forth the resources of the Canadas. That in consequence of the shallowness of the waters of the river Saint Lawrence, at Ile Platte and in some parts of Lake Saint Peter, vessels from sea are subjected to inconvenience and difficulties in their voyages between Quebec and Montreal, with the exception of such as are performed during the two months immediately following the opening of the navigation. That at later periods of the season, such vessels are either prevented from reaching Montreal, or are only enabled to do so after having discharged the principal part of their cargo. That the interest and prosperity of this province, as well as of Upper Canada, require that the obstructions to the navigation of this their great and common channel of communication should be removed whenever practicable, and the river to as great an extent as possible rendered at all times navigable to vessels from sea. That with such views of improvement, the merchants of the city of Montreal during last autumn, appointed the petitioners a committee to obtain information as to the practicability of the object, and in due time to make the necessary application to the Provincial Legislature, to whom peculiarly belong the honour and power of achieving a work of such extensive importance. That the petitioners beg leave to state as the combined result of their investigations, that it is practicable, without great expense, to deepen the channel at the places before mentioned, to a sufficient degree to render the river navigable at those seasons of the year when the water is lowest for vessels of two hundred and fifty tons burthen, with a full cargo. That the petitioners have ascertained by actual survey, that the substances which compose the bed of the river where the obstructions exist are such as can be successfully acted upon, and if any doubt could have been entertained of the practicability and advantage of performing the great public work in question, all such doubts would be removed from the circumstance that a tender has actually been made by a person of character, possessing the means and able to bring undoubted security for performance, to cut the necessary channel at the places required, viz: of the length of seven miles, of the breadth of twenty-five yards, and of the depth of sixteen feet, at low water, and to maintain the same in good order, during the space of three years from its completion, for the sum of thirty-six

thousand pounds currency. That no undertaking ever offered, for so inconsiderable an expense, a fairer prospect of important, extensive and lasting advantage, both to the Government and to the general commerce and improvement of both provinces, and that it is expected, and the estimate herewith produced will shew, that the performance of the work may probably be procured even for a smaller sum than has been hitherto proposed. That the immediate saving in freights upon the present scale of commerce would be about twenty thousand pounds annually, and when the future certain and rapid growth of trade and the advantage arising to government in cases of urgency from an unobstructed navigation of the river, are taken into consideration, the prospective and ultimate benefits attainable by the execution of the great object in question, must be deemed great beyond many of those which have already received public encouragement. The petitioners therefore humbly pray that the House may be pleased to take their petition and the accompanying document into consideration, and that an act of the Provincial Parliament may be passed granting such aid as may be deemed requisite to be expended in the clearing of the channel of the river Saint Lawrence at the Ile Platte, and in the Lake Saint Peter, as already mentioned, and to adopt such other measures for the furtherance of the great object in question, as in the wisdom of the House may seem meet.

On motion of Mr. Leslie, seconded by Mr. Heney.—

Resolved, that the said petition be referred to a committee of five members, to examine the contents thereof, and to report thereon with all convenient speed, with power to send for persons, papers and records.

Ordered, that Mr. Leslie, Mr. Cuvillier, Mr. Quesnel, Mr. Heney and Mr. Neilson do compose the said committee.

Report of Committee on the Navigation of the Lake St. Peter.

THURSDAY, 23rd. March, 1826.

Mr. Leslie, from the special committee to whom was referred the petition of a committee of merchants, of Montreal, reported

that the committee had examined the same, and had come to an opinion thereon, which he was directed to submit to the House, whenever it shall be pleased to receive the same; and he read the report in his place, and afterwards delivered it in at the clerk's table, where it was again read, as followeth:—

On the twenty-seventh ultimo, your committee ordered that two copies of the plan of Lake Saint Peter and l'Ile Platte, be prepared according to the survey made by Mr. Theodore Davis, one of the said plans to be made by the said T. Davis, and the other by Mr. Sax for the information of the committee; and on the fourteenth instant the said plans were laid before the committee.

Captain Joseph Defoy then appeared before your committee, and answered the following questions:—

1. Q.—Of what nature is the bottom of that part of the Lake which is below l'Ile Platte at the place called the Bar?

A.—The bottom is hard and rocky.

2. Q.—Do you think that the bottom could be deepened and cleared?

A.—I think it could, and the current which is very strong at that place would assist the clearing of the channel, and keep it in good condition.

3. Q.—Of what nature is the bottom of the second shoal opposite La Carpe shoal, going downwards.

A.—Sandy. I believe there are no stones there and the current there retains some strength.

4. Q.—Do you think it would be possible to deepen the channel over that shoal with any hope of success?

A.—No, I am of opinion that the same would fill almost as soon as excavated.

5. Q.—On what do you ground that opinion?

A.—The sand there is quicksand, and the fluctuation of the waters of the lake would disturb and move it sufficiently to fill up the excavation, and three or four days would suffice for that effect, if the wind were rather high.

6. Q.—Do you know the bottom of the third shoal (proceeding downwards) situate between Rivière du Loup and Mæchiche, and what is it?

A.—The bottom is mud and quicksand. There are muddy places, into which a pole may be easily thrust five or six feet deep, and others in which the bottom is very hard.

7. Q.—Do you think it would be possible to make a channel across that shoal in a durable manner ?

A.—I am convinced, for the reason above stated, that it would not.

8. Q. Is there any current in that part of the Lake where the shoal in question is situate ?

A.—No ; there is very little.

9. Q.—Do you think a channel made across the shoal would produce a current ?

H.—I do not think it would.

10. Q.—How long have you navigated between Quebec and Montreal ?

A.—Thirty-four years.

11. Q.—Have you observed any change in the shoals above mentioned since you began to navigate ?

A.—I have observed some change in the great shoal situate between Rivière du Loup and Machiche, in some places there is less water than formerly.

12. Q.—Do you attribute that change to the conveyance of sand by the current of the Rivers du Loup or Machiche ?

A.—No, those shoals are too far from the mouth of those rivers to be produced by that cause.

13. Q.—Is there less water on the great shoal in question than on the bar or shoal of l'Île Platte ?

A.—Yes ; the difference is about twelve or fifteen inches, and in loading vessels, attention is always paid to the depth of water on the great shoal I have mentioned.

14. Q.—Do you think there is any particular mode of improving the navigation of the lake, and can you suggest any such ?

A.—I know of none.

15. Q.—Do you think it would be practicable by means of a dyke or embankment at the entrance of the lake opposite Pointe du Lac to confine the water and raise it perceptibly ?

A.—I think not ; besides such a dyke could not resist the force of the ice. Besides, such a dyke, assuming its practicability,

would have the effect of increasing the velocity of the current so as greatly to injure the navigation of that part of the lake, where the current is already too strong.

Mr. L. A. Lagueux then appeared, and to the same questions as those put to Mr. Defoy, he made answer as follows :

- 1.—The bottom is hard and consists of gravel and stones.
- 2.—I think so.
- 3.—The bottom is of sand and mud.
- 4.—I think it might be deepened, but it would be again filled as soon as the lake became agitated.
- 5.—The same answer as Mr. Defoy gave.
- 6.—The same answer as Mr. Defoy gave, adding, I have thrust a pole nine feet into it.
- 7.—I am sure it would not, for the reasons already stated. The quantity of sand conveyed by the waters when agitated is such, that extensive quicksands are often formed, which are afterwards borne away as they were produced. I remember, that during the late war I ran aground on the point of the shoal opposite the river Machiche, the wind was north-westerly and the mud and sand accumulated ahead of the vessel so as to have only two or three feet water upon it. The next day the wind had veered to the north-west. The mud bank disappeared, and the vessel floated.
- 8.—The same answer as Mr. Defoy gave.
- 9.—I do not think so, because of the great breadth of the lake at that place.
- 10.—I navigated the river during twenty-three years ; but seven years ago I left off doing so.
- 11.—I have not observed any remarkable change.
- 13.—The same answer as Mr. Defoy gave.
- 14.—The same answer as Mr. Defoy gave.
- 15.—I think an embankment might be made which would occasion a rise of water, but I do not know whether that effect would be perceptible in the upper parts of the lake. I think besides that, were such an embankment practicable, it would have the effect of increasing the velocity of the current to the detriment of the navigation of that part of the lake. The current there is already considerable, and when the lake ice rushes past that place, it is borne along with great impetuosity and force.

Captain Lambly, harbour master of Quebec, then appeared:

Q.—From your knowledge of lake St. Peter, do you think it would be susceptible of such amelioration as to admit of the navigation of large vessels, and at every season.

A.—I was never in the Lake but once going upwards and downwards. The only practicable mode of improving it appears to me to make dykes at the eastern entrance of the lake, and if the current should become too strong, a lock should be made for shipping to pass through.

Mr. Pierre Page, pilot between Quebec and Montreal, then appeared, and the questions to captain Defoy being also put to him, he made answer as follows:—

1.—The bottom is hard and rocky.

2.—I think so.

3.—The bottom is sandy.

4 & 5.—I think it might be deepened, but it would fill again every high wind.

6.—The bottom consists of mud and quicksand.

7.—It might be done, but would not be very durable.

8.—Not so much as on other shoals.

Q.—I think so.

10.—For seventeen years.

11.—The shoals change every year. The heaving out of ballast, and the annual action of the ice occasion the shifting of the sand.

13.—The water is one half foot deeper at the Isle Plate than on the shoals of the lake.

14.—No; I am not aware (the effects of the winds being so great) that there is any.

15.—That would be very difficult; the breadth of the lake being so very great, and the current at Nicolet so strong.

Your Committee having procured detailed plans of Lake St. Peter, proceeded to examine witnesses as to the possibility of carrying into execution the proposed plan for deepening the said lake. From the evidence hitherto adduced, it appears to your committee manifest that that undertaking would not be crowned with success, inasmuch as any channel which might be excavated in the bottom of the lake would be almost immediately

filled up by the quantity of sand conveyed into it by the waters of the lake when agitated by the wind. The matter being nevertheless of the utmost importance to the general interest, your committee were desirous of procuring more complete evidence, and of examining a larger number of witnesses conversant with the subject than they have found it possible to do, by reason of the absence at the time of most of the pilots and river craftsmen possessed of information on the subject.

Your committee are therefore of opinion that the importance of the measure requires that further information be obtained, which many easily be done in the next session of the Legislature.

It is interesting to note that ignorance of the true nature of the bottom of Lake St. Peter led even the most experienced pilots of that day to the belief that a channel excavated through the lake would be immediately filled by shifting sand or by the sides of the dredged channel falling in. Further investigations, especially those in 1855, proved this opinion to be erroneous, and actual experience up to the present time establishes beyond a doubt that a channel once obtained in the St. Lawrence is practically permanent.

In the year 1827 the following petition, accompanied by soundings and a report of a survey of Lake St. Peter, was presented to the Legislative Assembly of Lower Canada :—

Extract from Journals of the House of Assembly of Lower Canada.

TUESDAY 6th February 1827.

Mr. Leslie read in his place a petition of the committee of merchants of Montreal whose names are thereunto subscribed.

After which, Mr. Leslie informed the House that His Excellency the Governor-in-chief, being acquainted with the purport of the said petition, gives his consent that the House may proceed hereon as they shall think fit.

And the said petition was received and read, setting forth ; That at the last session of the Provincial Parliament the petitioners had the honor to present a petition praying for a grant of money in aid of deepening the channel of the river St. Lawrence at the Isle Platte and in Lake St. Peter, to which petition they beg leave to refer the House. The petitioners respectfully ask permission further to shew, that for the still better ascertaining the practicability of deepening the river St. Lawrence at the aforementioned places, they caused another survey to be taken by persons experienced in the different qualities of soil, well provided with augers and other instruments for boring and bringing up specimens from the bed of the river ; where the excavation is required, which specimens they carefully examined, and afterwards submitted to the inspection of Colonel By, of the Royal Engineers, and other scientific persons, who unanimously gave as their opinion that the object in question was perfectly practicable, at a moderate expense, and that from the tenacity of the soil, the channel when once cut would not again fill up ; all which will more fully appear on reference to the accompanying document. The petitioners therefore humbly pray that the House may be pleased to take their petition into consideration, and that an Act may be passed granting such aid as may be deemed requisite to effect the deepening of the channel of the river St. Lawrence at Isle Platte, and in Lake St. Peter, and prescribing such other means for the furtherance of the great improvement in question as the House in their wisdom may deem meet.

A report of a survey of Lake St. Peter, made by the undersigned on the eleventh day of September one thousand eight hundred and twenty-six, from on board the steamboat "Lady of the Lake," for the purpose of ascertaining the practicability of deepening it so that vessels drawing fourteen feet of water may pass at all seasons. The day fine, clear and calm which allowed the mensuration to be accurately taken and the results are as follows :—

DEPTH OF		QUALITY OF SOIL.	NUMBER OF SPECIMENS	REMARKS.
WATER.	BORR.			
<i>Feet.</i>	<i>Feet.</i>			
22				Commenced sounding one mile below Petit Bois de Machiche, and continued up Ship Channel.
21				
20 $\frac{1}{2}$				
20				
19				
18	5	Clay.	No. 1.	Off Petit Bois de Machiche
18				
17 $\frac{1}{2}$				
17				
16 $\frac{1}{2}$				
16				
15				
15				
14 $\frac{1}{2}$				
14	10	Clay.	" 2.	By weight of the auger in falling from the deck.
14 $\frac{1}{2}$				
14 $\frac{1}{2}$				
14	9		" 3.	Grand Bois de Machiche.
14				
13 $\frac{1}{2}$				
13				
13	7	Clay and a small part of coarse sand.	" 4.	Off Machiche Church.
13				
13				
13				
12 $\frac{1}{2}$				
13	8 $\frac{1}{2}$	Clay and sand.	" 5.	
13				
13				
12				
12				
12				
12				
11 $\frac{1}{2}$	9	Clay and sand.	" 6.	
11	1	Do.	" 7.	Crust at top, hard.
11	9	Do.	" 8.	
11	8	Do.	" 9.	
11 $\frac{1}{2}$	8 $\frac{1}{2}$	Do.	" 10.	
11				
11 $\frac{1}{2}$	8 $\frac{1}{2}$	Clay.	" 11.	
11	8 $\frac{1}{2}$	Do.	" 12.	
11 $\frac{1}{2}$	9	Do.	" 13.	
12				
11 $\frac{1}{2}$	8	Do.	" 14.	
11 $\frac{1}{2}$	8	Rough sand & clay	" 15.	Top crust hard. } Off Riv. Do. } du Loup
12	8	Do.	" 16.	

DEPTH OF		QUALITY OF SOIL.	NUMBER OF SPECIMENS	REMARKS.
WATER.	BORE.			
<i>Feet.</i>	<i>Feet.</i>			
13½	8	Clay.	No. 17.	Top crust hard. { Off Riv. du Loup
15				
16				
17				
18				
19½				
31½				
30				
30				
24				
21				
18				
18				
18				
18				
18	3	Clay.	" 18.	Lower buoy.
16½				
18				
18				
17	5	Clay.	" 19.	
17				
17				
16½	7	Clay.	" 20.	
15				
15	5	Clay.	" 21.	
16½				
16½				
16½				
16½				
16½				
15				
14½				
13½	9	Clay.	" 22.	Upper buoy.
13				
12				
11½				
13½				
13				
13				
13				
12½				
13				
13½				
13½				
13½				
15	9	Clay,	" 23.	Soft, soapy, blue clay.

A SURVEY OF THE SHOALS OFF LAVALTRIE, COMMENCING HALF
A MILE BELOW THE BUOY.

DEPTH OF		QUALITY OF SOIL.	NUMBER OF SPECIMENS	REMARKS.
WATER.	BORE.			
<i>Feet.</i>	<i>Feet.</i>			
19½				
18				
18				
18½				
19½				
18				
17				
17				
16½				
16½				
16	2	Clay.	No. 24.	
15½	3	Do.	" 25.	
17				
17				
19				
18½	2	Clay.	" 26.	Opposite the buoy.
18				
19				
21				
19½				
16½				
16				
17				
15½				
14½	2	Clay.	" 27.	
15				
17				
16				
19½				

After a most careful inspection of the soil, brought up by the auger in the different borings, we are [unanimously of opinion, that the proposed ship channel can be cut at a moderate expense, and when once cut, the tenacity of the soil is such throughout, there will be no danger of its filling up again.

We are also of opinion that the said specimens taken from the lake are not native soil; but ballast thrown out from vessels.

The specimens are all separately numbered in a box and go addressed to James Leslie Esq., M. P. P.

T. PORTEOUS,
ANDREW WHITE,
JAS. GREENFIELD,
JOHN COATS.

MONTREAL, 14th September, 1826.

Sir :—

I have perused the enclosed report of the survey of Lake St. Peter made on the eleventh September one thousand eight hundred and twenty-six, on board the steamboat Lady of the Lake, for the purpose of ascertaining the practicability of deepening the said Lake so that vessels drawing fourteen feet of water may pass at all seasons; and having examined with attention the accompanying twenty-seven specimens of the soil brought up by the auger at the different borings I have the satisfaction of stating that such is the tenacity of all these specimens that I have no hesitation in stating a durable bank may be formed with the soil excavated in forming the proposed Ship Channel; and I am of opinion that when this most desirable object is once effected, the channel will remain clear for ages, provided the excavated soil is removed three hundred yards from the proposed cut, and placed on the lower side, so that the wash which will take place from the waves breaking over the bank, may be carried from, instead of into the proposed cut. Wishing every success to this laudable undertaking.

I have the honor to be,

Sir,

Your most obedient humble servant,

JOHN BY,
Lt.-Col Royal Engineers.

T. PORTEOUS Esq.

On motion of Mr. Leslie, seconded by Mr. Quesnel.

Resolved.—That the said petition be referred to a committee of five members, to examine the contents thereof, and to report thereon, with all convenient speed, with power to send for persons, papers and records.

Ordered.—That Mr. Leslie, Mr. Dumont, and Mr. Quesnel do compose the said Committee.

We next meet with official records relating to the Ship Channel in the year 1831, when the following report of Captain Bayfield's was laid before the Legislature:—

Extract from the Journals of the House of Assembly of Lower Canada.

WEDNESDAY, 14th December, 1831.

AYLMER, .
Governor-in-Chief.

In concurrence with the Governor-in-Chief's communication of the 9th, in answer to the Address of the House of Assembly of the 7th inst., he now transmits the accompanying copy of a report from Captain Bayfield, of the Royal Navy, for the information of the House.

Castle of St. Louis,
Quebec, 14th December, 1831.

QUEBEC, 9th May, 1831.

MY LORD,—

At the time when the subject of deepening Lake St. Peter, by the employment of a steam dredging machine, was under the consideration of the Legislature, it was proposed to have a

correct survey made of the lake, with the view of ascertaining the practicability or the best mode of deepening the channel for large vessels. Sir James Kempt did me the honour to consult me on this subject, and I represented to him that there would be no necessity for the Province to incur the expense of the survey required, as it was a part of the labour allotted to me by the Admiralty. I also promised to make the survey at the earliest possible period consistent with my orders, and it was also Sir James Kempt's desire that I should report to him my observations on the nature of the lake, its channels, &c.

The survey was completed last October, and transferred to paper during the winter; I have, therefore, to offer to your Excellency the following remarks:—About two miles above the town of William Henry, the St. Lawrence suddenly expands, and here the Lake St. Peter, in a geographical sense, may be said to commence, its south-western part being occupied by a number of alluvial islands, the lowest visible stratum of which is of a tenacious blue clay, which appears at the water's edge when the lake is low. Over this is a stratum of sand, in which are vegetable remains and fresh-water shells, similar to those existing in the lake. These islands have evidently been formed by the river, which has continued for ages to bring down alluvial matter, which has subsided when it reached the more tranquil water of the lake, which was then no longer capable of holding the earthy particles in suspension. In a distance of several miles back from the present shores of the lake, and all around it, the country is low and flat. In digging wells or making other excavations, the two strata, the one of sand and the other below it of blue clay, are met with. This flat country is terminated all round by a ridge, which appears to have been the ancient margin of the lake, when the waters occupied a higher level than at present. These appearances, and others on the islands, lead me to think that there has been a subsidence of the water, and if this be the case, the probable cause is the wearing away of a barrier lower down the river, perhaps at the Richelieu Rapid, where there is still a fall of some feet at low water, as appears by the different rise of the tide at the foot and head of that rapid. The operation of the river in forming islands and shoals in the lake is still going on. In the slack water at the lower end

of the islands, fresh accumulations of sand and clay are constantly forming. There are some occupied by a thick growth of reeds and other aquatic plants, which serve to bind the mass together, and prevent the loose particles from being washed away. Drift timber lodges and adds to the mass, till at last it becomes a swampy island. The trees which grow in such situations now spring up, whilst every freshet in the spring, at the melting of the snow, covers it with water holding an immense quantity of alluvial matter suspended, which had previously been washed from the higher grounds. This is deposited to a depth of several inches in some situations, so as in some instances which I have observed, completely to cover the leaves which had fallen in the preceding autumn. Hence, and from the accumulation of vegetable matter, these islands and the low grounds round the lake are constantly rising. Lower down extreme shoals have been formed, extending several miles from the lower end of the islands to the comparatively slack water. All around the lake similar deposits were observed, and are constantly, although slowly, accumulating and contracting the limits of the navigable channel. In proportion as it is so contracted, it is reasonable to suppose that it will deepen, as the current of the river will then be confined within a narrower space. The process, however, is so slow that a very great period of years must elapse before it can produce any sensible effect. The extensive deposits off the mouth of the Yamaska, St. Francis, &c., aid much in the process of filling up the lake. The tendency of the St. Lawrence itself appears to be, and to have been for many years past, to gradually shut up the smaller and more northerly channels at their heads by a bank of sand across them. In proportion as the operation proceeds, less water can flow down these channels, and out of them into the lake; hence the volume of water is not sufficient to keep open a deep channel through what may be called the bar, and these channels, therefore, decrease in depth at the lower end in proportion as they do at the upper. In several of the smaller channels the process has been completed by their being closed at the upper end. The Berthier Channel, at present used by the smaller steamboats and other vessels, is fast closing at the upper end, having at present only seven feet of water in that part. If the dredging machine should come into

operation, and from local interests it should be desired to deepen or open any of these smaller channels, it would become a matter of consideration whether such desire should be complied with, as there can be no doubt but the closing of the minor channels, by causing more water to flow through the larger channels, which all meet together below the islands, would tend to deepen the one navigable channel through the lake.

Having thus had the honour to submit to your Lordship's consideration what I conceive to be the natural operation at present going on in Lake St. Peter, and on which the nature of the channel through it in a great measure depends, I have now to describe that channel, and to offer you my opinion as to the practicability of deepening it, limited as it must be, by my acquaintance with the powers of the machine to be used for that purpose.

The ship channel is sufficiently deep for the largest vessels all the way between the islands, nor does it become shoal until we arrive (descending) at a point about three miles below the most eastern island. Here there is a narrow pass between the shoal which extends off that island, and those off the rivers Yamaska and St. Francis, through which the united waters of the larger channels pass. At this pass, the light-vessel and buoy are placed; its width is about half a mile, and the depth of water is 14 feet for about the same distance. This is called the bar, and were there no other obstruction it would be easy to deepen the channel. For a distance of about three miles further down, the channel, which becomes much wider, is sufficiently deep. It then expands into an extensive flat for a distance of six miles (always nautical miles) over which, when the waters are low in autumn, there is only $11\frac{1}{2}$ feet of water. The bottom is of a few inches of sand over a tenacious but not very hard clay, similar to that of the islands. There is little doubt but that this might be removed; but your Lordship will perceive that the distance which requires deepening is very great, and I think that the sand would be constantly washing into the deepened channel, so that the dredging vessel would require to be constantly at work. Whether even then she could preserve a deep channel must depend upon her powers and the result of experiments.

Below the flat just mentioned, the channel is again contracted in width by shoals, and continues deep to the outlet of the lake.

I have, &c., &c.,

(Signed) HENRY WM. BAYFIELD,

Commander Royal Navy,
Surveying the St. Lawrence.

His Excellency Lt.-Gen. Lord Aylmer,
&c., &c.

Resolved.—That the message of his Excellency the Governor-in-Chief, with Captain Bayfield's report relating to Lake St. Peter, be referred to a committee of five members, to examine the same and report thereon with all convenient speed, with power to send for persons, papers and records.

Ordered.—That Mr. Leslie, Mr. Cuvillier, Mr. Quesnel, Mr. Young, and Mr. De Witt do compose the said committee.

The efforts of 1825 to 1831 do not appear to have induced the Government to grant any aid to the enterprise of improving the ship channel in the St. Lawrence and the matter seems to have dropped out of sight or at least remained in abeyance until the year 1836 when the merchants of Montreal again petitioned the Legislature for aid to make a survey of lake St. Peter. The following extracts from the journals of the house contain an account of this petition and the action taken thereon :—

Minutes of Evidence taken before the Standing Committee of Trade, on the Petition of divers Merchants and others of the City of Montreal, praying for a grant of money for the purpose of making an accurate survey of the obstructions in the navigation of Lake St. Peter, and the river St. Lawrence upwards to Montreal.

(Reported 15th February. 1836.)

SATURDAY, 16th January, 1836.

James Leslie, Esquire, in the Chair.

Captain Henry W. Bayfield, Royal Navy, surveying the river St. Lawrence, called in; and examined:—

Have you been employed by the Lords of the Admiralty in making a survey of Lake St. Peter, and the river St. Lawrence upwards to Montreal?—Yes.

Are the soundings, shoals, channels and soils of the bottom of the lake and river laid down in that survey?—Yes, and the nature of the bottom is indicated by the sounding lead.

Will you furnish the Committee with a copy of the survey?—It is not in my power to do so without a permission from the Lords of the Admiralty.

From your knowledge of that part of the St. Lawrence, do you think it would be practicable to deepen the channel so as to allow vessels of a greater burthen to proceed to Montreal than its depth at present admits?—Yes, I think it possible, although I consider it a work of great difficulty.

In what manner are you of opinion that object could be accomplished?—Either by excavating the present channel through the St. François shoal, for a distance of about two miles, by which however, only six inches, or at most one foot, increase of depth, would be gained, or to obtain a greater depth, a channel must be excavated, through the flats of lake St. Peter, $4\frac{1}{2}$ nautical miles in length; a work that would require so much time and labour, that, with the means contemplated, it is not improbable, that the end first excavated might be filled up by sand washing in, by the time the other was reached. The magnitude of such a work will be best understood by the statement, that if it were contem-

plated only to obtain an increase of two feet in depth, and to limit the width of the excavation to 200 feet, (and it could not well be less to allow vessels to turn in it, and to pass each other without risk,) no less than eleven millions of cubic feet of soil would have to be removed to effect it.

Do you consider that a dredging machine of 40 horse-power would be of utility in such an operation?—I am unacquainted with the nature of a steam dredging machine. I only know that they are employed with success in clearing out small harbours and canals; from which I conclude that such a machine would be of utility in the operation contemplated; but whether its powers would be equal to the work under consideration, or not, I can form no opinion. In order to do so, it would be necessary to know how many cubic feet of sand and clay the machine could excavate per day.

In what manner could the shoals at Ile Platte be removed? In the same manner, and by the same means, as have been contemplated for lake St. Peter.

Do you think the strength of the current sufficient to keep clear any part of the lake that might be excavated, or are there places where, from the bottom being quick sand, it would fill in at short periods by the agitation of the waters?—The current is too weak over the flats to have much effect in keeping a channel clear; but considering that the excavation would be cut through clay, with only a thin superstratum of sand, I think it probable that the dredging machine would be able to keep it clear. There are no quick sands in the part of the lake which would have to be deepened.

Do you think a channel made across any of the shoals in the lake or river above would produce a current sufficient to keep the channel from again filling up?—No, certainly not.

Have you observed any change in the shoals since you were acquainted with this part of the St. Lawrence?—No.

Do the rivers of Machiche, du Loup and Yamaska, deposit annually in the lake any great quantity of sand or other soil, so as to affect the channels of the lake?—All the rivers mentioned, but particularly the Yamaska and St. François, bring down great quantities of earthy matter, which are deposited when they reach

the comparatively still waters of the lake; but any effect in the channels of the lake from this cause is insensible, excepting after long periods of years.

Is there more or less water in the lake than in the shoals at Ile Platte?—There is very little difference. There may be six inches more water in the shoal part of the channel above Isle Plate.

Do you think that the sands in the lake are moved by the agitation of the waters from high winds?—Not in so great a degree as to affect the channels.

Do you conceive that the action of the ice has any effect on the shifting of the shoals?—The ice moves the tops of the shoals where there are only a few feet of water, but does not shift them bodily, so as to affect the navigation.

Are you of opinion that the soil, stated in your survey as composing the bottom of the lake, is primitive, or composed of ballast thrown out by vessels?—The soil, stated in my survey as composing the bottom of lake St. Peter, is the natural deposit from the river St. Lawrence and its tributary streams, and not the ballast thrown out by vessels.

Extract from the journals of the Legislative Assembly of Lower Canada.

17th September, 1836.

SURVEY OF THE RIVER ST. LAWRENCE.

GOSFORD,
Governor-in-chief.

With reference to the address of the House of Assembly of the 15th of February last, praying the Governor-in-Chief to make application to His Majesty's Government to obtain for the use of the Province, a copy of the survey of that part of the river St. Lawrence from Three Rivers to Montreal, made by Captain

Bayfield of the Royal Navy, under the direction of the Lords Commissioners of the Admiralty, the Governor-in-Chief has great pleasure in communicating to the House of Assembly, that he has been informed by the Secretary of State for the colonies, that as soon as the Chart shall have been engraved, a copy of it shall be transmitted as prayed for by the House of Assembly.

GOSFORD.

Castle of St. Louis,
Quebec, 27th September, 1836.

Again in 1838, the Montreal Committee of Trade petitioned the Legislative Assembly of Lower Canada for a grant of money to make a survey of lake St. Peter, as shown in the following extracts from the journals of the special council :—

Extract from the Journals of the Special Council of Lower Canada.

May 5th, 1838.

J. COLBORNE,
Administrator.

The Administrator of the Government, in transmitting for the consideration and adoption of the Special Council, "An Ordinance to make provision for the survey of lake St. Peter," acquaints the Council, that if it should be deemed of importance to the interest of the Province, that the projected measure should be passed immediately, he proposes that the Standing Orders, respecting the reading of Ordinances be dispensed with on this occasion.

Government House,
Montreal, May 5th, 1838.

The following petition accompanied the said message :

To His Excellency Sir John Colborne, G.C.B., Administrator of the Government of the Province of Lower Canada, etc., etc., etc.

The petition of the Montreal Committee of Trade,

Respectfully sheweth:—

That lake Saint Peter, during the greater part of the season of navigation, is so shallow as not to admit of the passage of vessels through it, drawing more than from ten to twelve feet of water. That the draught of water of the vessels employed in the trade between Montreal and the United Kingdom, averages from fourteen to sixteen feet, which renders it necessary to transfer a considerable portion of their cargoes to enable them to pass through the lake, entailing upon the trade of Montreal an immense annual expense, as well as causing detention to the ships.

That from the shallowness of the water in lake Saint Peter, preventing any but small vessels from completing their loading above the lake, Montreal does not participate in any of the advantages derived from the trade in timber, the principal staple in Canada.

That your petitioners are assured, by scientific men, that the ship channel in lake Saint Peter could be deepened to sixteen feet at no very considerable expense. The advantages that would be derived from such an improvement are too apparent to render it necessary for your petitioners to dwell upon them, and they humbly pray, that Your Excellency will be pleased to recommend to the Special Council, that a sum of money should be appropriated to defray the expenses of surveying lake Saint Peter, with a view to ascertain the practicability of its being deepened, so as to admit the passage of large vessels across it.

And your petitioners as in duty bound, will ever pray.

On behalf of the Committee,

(Signed,)

AUSTIN CUVILLIER,

Chairman.

Montreal, 5th of May, 1838.

This petition seems to have been considered immediately, and the following ordinance granting £500 for the purpose of making a survey of Lake St. Peter bears the same date as the petition :—

1st Vic. Cap. 26—1838.

AN ORDINANCE TO MAKE PROVISION FOR THE SURVEY OF LAKE SAINT PETER.

Whereas it is expedient to provide for the survey of lake Saint Peter in this province :—Be it therefore ordained and enacted by His Excellency the Administrator of the government of the said province, authorized to execute the commission of the governor thereof, by and with the advice and consent of the special council for the affairs of the said province constituted and assembled, by virtue and under the authority of an Act of Parliament of the United Kingdom of Great Britain and Ireland, passed in the first year of the reign of Her present Majesty, intituled, “ An Act to make temporary provision for the Government of Lower Canada ;” And it is hereby ordained and enacted by the authority of the same, that it shall be lawful for the governor, or person administering the Government of Lower Canada to advance by warrant under his hand and out of the unappropriated moneys in the hands of the Receiver General, a sum not exceeding five hundred pounds currency, as an aid towards causing a survey to be made of lake St. Peter in this province.

II. And be it further ordained and enacted by the authority aforesaid, that it shall be lawful for the governor, lieutenant governor or person administering the government of this province, to appoint, by an instrument under his hand and seal, one or more commissioner or commissioners to carry this ordinance into effect.

III. And be it further ordained and enacted by the authority aforesaid that the due application of the money appropriated by this ordinance, shall be accounted for to Her Majesty, her heirs, and successors, through the Lords Commissioners of Her Majesty's Treasury for the time being, in such manner and form as Her

Majesty, her heirs and successors shall direct, and that a detailed account of the expenditure of all such moneys shall be laid before the governor, lieutenant governor, or person administering the government of this province.

J. COLBORNE.

Ordained and enacted by the authority aforesaid and passed in special council, under the great seal of the province, at the Government House in the city of Montreal, 5th May, 1st year of the reign of Our Sovereign Lady Victoria, by the Grace of God of Great Britain and Ireland, Queen, Defender of the Faith, etc., in the year of Our Lord 1838.

By His Excellency's command,

W. B. LINDSAY,
Clerk Special Council.

Nothing more of an official character appears until 1841 when action was taken on the petition of the Board of Trade of Montreal. We find the following letter from the Hon. Mr. Secretary Daly to the Chairman of the Select Committee of the House of Assembly :—

D.

NOTE.—Referred to in Table of Contents, Appendix to Report of August, 1841.

Letter from the Hon. Mr. Secretary Daly, to the Chairman of the Committee.

SECRETARY'S OFFICE, KINGSTON, 25TH JUNE, 1841.

SIR,

I have the honor to acknowledge the receipt of your letter of yesterday's date in reference to the petition of the Montreal committee of trade which has been entrusted to you for the purpose of being presented to the House of Assembly. In reply,

His Excellency has commanded me to inform you that the improvement of the navigation of lake St. Peter will be considered with other public works.

I have the honor to be,

Sir,

Your most obedient humble Servant,

D. DALY,

Secretary

THE HON. G. MOFFATT, M. P. P.

The investigations of the Special Committee of 1841 are given in the following report:—

REPORT.

August, 1841.

The Special Committee to whom was referred the petition of the Board of Trade of Montreal, praying that measures may be taken to deepen the ship channel in lake St. Peter, having examined the same, have the honor to report:—

That the importance to the trade of the Province of the subject brought under the consideration of your Honorable House by this petition, occupied the attention of the House of Assembly of Lower Canada at different times previous to the year 1836, without leading to any conclusive opinion as to the practicability of the proposed undertaking; but as the petitioners were officially informed, on the 25th June last, that “the improvement of the navigation of lake St. Peter would be considered with other public works,”—and as Mr. David Thompson is actually engaged in completing the survey requisite to a full consideration of the subject, your Committee have not thought it necessary to extend the enquiries already made on this point, and have therefore confined their attention chiefly to two other

points, namely, the extent of the burden imposed on the trade by the obstructions to the navigation which it is sought to remove, and the means of raising a fund, on the completion of the work, to defray the interest and ultimately refund the principal of the outlay required; which Mr. Thompson estimates at the sum of thirty-five thousand pounds, to be expended in three years.

With a view to obtain information on those points, your Committee addressed a series of questions to eighteen persons and firms in Montreal; they also addressed the Commissary General, and the Naval Commander on this station,—and they required from the collector of the port of Montreal, returns of the vessels entered and cleared at that port, for the years 1839 and 1840, and for the present year, up to the date of the return.

These questions and the answers received, and the returns made by the collector at Montreal, are annexed to this report, to which your Committee beg leave to refer.

With respect to the first point,—the burden imposed on the trade by the existing obstructions, the information communicated to your Committee is not so ample as they had reason to expect. During the last year, 97 vessels from sea, burthen 28,660 tons, arrived in the port of Montreal—of these, the charges for towage and lighterage on 42 only, burthen 14,179 tons, have been furnished; the charges on the same are as follows:—

Towage upwards.....	£2,546	1	7
do downwards.....	1,082	1	8
Lighterage upwards	1,151	5	0
do downwards	1,361	17	8
	<hr/>		
	£6,141	5	11

Without towage upwards, the amount would be £3,595 4 4, and for lighterage only £2,513 2 8, making in the one case fully 5s., and in the other 3s. 6d. per ton, on the passage of these 42 vessels up and down the river,—or the one half of these rates each way. But the larger sum would probably prove to be the real saving, because vessels ascending the river frequently engage the steamer, although the wind be at the time favorable,

in order to avoid detention in case of grounding in the lake ; and the saving therefrom would probably at least counterbalance any portion of the charge for towage downwards, which, for the sake of dispatch, might be occasionally incurred after the navigation had been improved.

Of the tonnage upon which the foregoing calculations are based, a considerable portion paid neither towage nor lighterage, so that the 42 vessels may present a fair average of the charges to which the whole tonnage of last year, say 28,660 tons inwards, and 29,439 tons outwards, was subjected ; thus the amount paid for towage downwards and lighterage last year would be £7,262 17 6, and for lighterage only £5,084 0 3 ; and the same rates applied to the assumed scale for the present year : say 50,000 tons each way, would give, in the one case £12,500, and in the other £8,750, exclusive of the injury done to property by transhipment, and loss from detention, which the evidence states to be very burdensome to the trade.

With respect to the second point, the following is the result of the collector's returns excluding therefrom river crafts and coasters :—

F.—G.

NOTE.—Referred to in Table of Contents, Appendix to Report.

INWARDS.

Entered in	1839.	Vessels 79.	Tonnage 22,334
do in	1840.	do 98.	do 28,660
do to 3rd August	1841.	do 127.	do 33,645
do	1840.	do 54.	do 15,428
do	1839.	do 39.	do 10,748

OUTWARDS.

Vessels	80.	Tonnage.....	22,757
do	98.	do	29,439
do	116.	do	31,457
do	50.	do	14,380
do	34.	do	9,758

It is probable from this statement, that the arrivals at the port of Montreal during the present season, will equal, if they do

not exceed the estimate made by the petitioners, namely, 200 vessels of the average burthen of 250 tons; and from the evidence annexed to this report, little doubt can be entertained that the rendering of the navigation between Quebec and Montreal practicable at low water for vessels of 16 feet draught, would be followed by a progressive accession to that number.

About ten or twelve years ago, the late Mr. Thomas Porteous, and others, with ample means, would have undertaken to deepen the channel of the lake, and keep it open for three years, for £36,000; the process of dredging is now better understood, and Mr. David Thompson's estimate, which is also annexed to this report, for a much wider and deeper channel, is only £35,000, including interest on the expenditure to the completion of the work—but say £40,000, the interest thereon at 6 per cent. would be £2,400, and to cover which, a tonnage duty of one shilling (or six pence each way) on 200 vessels of an average burthen of 250 tons, would suffice. This rate would be only 2-7ths of the expense actually incurred last year for lighterage alone, and if found sufficient to create an adequate fund to meet the annual charge, and gradually pay off the principal, it might be increased without being burdensome to the trade; but in order to draw the produce of the west down the St. Lawrence, it will be expedient to make the transit charges as light as possible; and when your committee take into view what has been effected for the city of Glasgow, under circumstances somewhat analogous, they feel the greater confidence in the favourable results to be anticipated from the deepening of lake St. Peter, and believe that the fund proposed to be established, would prove sufficient to protect the provincial funds from loss by the undertaking.

The tonnage dues collected at Glasgów, on shipping arriving at the Broomielaw amounted in the year 1820. to £6,328 18 10; in 1830 it was £20,296 18 6, and in 1839, £43,287 16 10. The customs duties collected at Glasgow during the same period, were in the year 1820, £11,000, in 1830, £59,014, and in 1839, £468,975.

In conclusion, your committee beg leave to recommend the prayer of the petitioners to the favourable consideration of your honorable house that measures may be taken to deepen the ship channel in lake St. Peter.

All which is nevertheless, humbly submitted.

26th August, 1841.

G. MOFFATT,
Chairman.

*Statement of Towage and Lighterage paid on sundry Vessels entered
and cleared at Montreal in 1840.*

CONSIGNEES.	No of Vessels	Tonnage.	Cost of Towage up.	Cost of Lighterage up.	Cost of Towage down.	Cost of Lighterage down.
Millar & Co.....	14	4,803	£ 911 19 10	£ 590 9 11	£ 421 8 7	£ 453 15 4
Dougal, Irvine & Co.	5	1,532	232 11 0	35 14 8	33 4 0	114 16 11
Gillespie & Co.....	13	4,895	769 15 4	396 18 11	348 2 10	554 2 4
A. Shaw.....	5	1,593	320 5 8	5 15 0	143 11 7	98 3 1
Buchanan & Co.....	1	390	66 5 4	122 6 6	44 3 4	82 10 0
McIntosh & Co.....	4	1,366	245 4 5	.....	91 11 4	58 10 0
	42	14,179	£2,546 1 7	£1,151 5 0	£1,082 1 8	£1,361 17 8

APPENDIX TO REPORT.

TABLE OF CONTENTS.

A.—Evidence taken by the Committee.

B.—Letter from Captain Sandom, R. N., commanding on Canadian waters, in reply to a letter from the Chairman of the Committee.

C.—Letter from Commissary-General Sir R. J. Routh, do. do.

D.—Letter from the Honorable Mr. Secretary Daly, do.

E.—Estimate of the expense of deepening the waters of lake St. Peter, by D. Thompson, Esq., civil engineer.

F.—List of vessels entered "inwards" at the Port of Montreal, in 1839 and 1840, and to 3rd August 1841, with their tonnage.

G.—List of vessels cleared "outwards" from do. during the same period.

A.

EVIDENCE TAKEN BEFORE THE COMMITTEE.

GENERAL QUESTIONS PROPOSED TO WITNESSES.

No. 1.—Will you furnish, for the information of the committee, a list of the vessels entered and cleared by your house at the Port of Montreal during the year 1839 and 1840, with the tonnage thereof and the charges incurred for lighterage and towage up and down the river stated under separate heads?

No. 2.—For what portion of the navigable season are vessels of 16 feet draught of water under the necessity of employing lighters in passing lake St. Peter to and from Montreal?

No. 3.—Are vessels drawing 16 feet water a suitable class for the trade to Montreal ?

No. 4.—If the river between Quebec and Montreal were rendered navigable at low water, for vessels of that draught, would it, in your opinion, induce a greater number to come to the latter port, and tend to reduce the rates of freight, between the same and the ports of the United Kingdom ?

No. 5.—If the navigation were so improved, would any, and what portion of the charge for towage downwards be saved to the trade, and would not the whole of the charge for lighterage be saved ?

No. 6.—Is the lighterage, apart from the direct charge for the same, attended with delay and injury to the property which is very burdensome to the trade ?

No. 7.—Can you state to the committee what would be the probable yearly saving to the trade of the province from lighterage, towage, &c. computed on the scale of the trade for the years 1839 and 1840, which would be effected by the proposed improvement of the navigation between Quebec and Montreal.

ANSWERS OF WM. EDMONSTONE, ESQ., OF THE FIRM OF MILLAR,
EDMONSTONE & ALLAN.

Answer to No. 1.—I accompany this with statement of the Tonnage, Register (new and old), draft of the water on arrival in, at and departure out, from Quebec, as well up to and down from Montreal and also the towage and lighterage up and down,—of vessels to the consignment of Millar, Edmonstone and Allan, in the year 1839 and 1840.

Answer to No. 2.—The water begins to lower immediately on the moving of the ice, but our spring ships seldom or ever require lighterage up ; the north waters coming down from the middle of May till about the first week in June, (some years later,) raises the water in the St. Lawrence sufficiently to allow ships of 15 or 16

feet draught of water to take their loading at Montreal, requiring but seldom to lighten down; we get them off in the last week of May and in the first week in June; so soon as the north waters have passed, vessels of the usual size of our trading vessels require lighterage. This last spring there was no rise on the St. Lawrence from the north water.

Answer to No. 3.—Vessels of 14 to 16 feet draft of water are very well suited for the Montreal trade in the present state of the navigation, except in the middle of the season of navigation, when the water becomes so shallow in the lake and in some places above it, that vessels cannot pass with a greater draft of water than 11 to 12½ feet, and some seasons even less, such a class of ships as our regular traders can then take but little freight on board at Montreal.

Answer to No. 4.—If there were a depth of water of 16 feet from Montreal downwards, throughout the season of navigation, there is not a doubt that many more vessels would resort to Montreal than at present, for in the case of their not obtaining full cargoes of flour, wheat, ashes, and such freight, they would take lumber for part of their cargoes, either in the log or in the deal, and as square timber may be stowed in the bottom, no vessel could with advantage take in flour, &c., at Montreal to discharge again at Quebec for the purpose of taking in the lumber part of the cargo required to complete her loading.

The expectation that there would be very large quantities of flour and wheat for shipment this summer, induced a much greater number of vessels to resort to Montreal than usual, and more came up than were required to carry off such freight; some took lumber cargoes in Montreal, whilst others, (some of which came from home in ballast,) fell back on Quebec for lumber cargoes, there were others that accepted of such low freights as would not, in any opinion, pay their disbursements. The freight between Montreal and the ports in the United Kingdom would certainly be less were the ships' disbursements reduced by the amount of lighterage and towage that is now paid, and the quantity of lumber shipped at Montreal would increase yearly, and cause a more regular supply of shipping.

Answer to No. 5.—Were the navigation free for vessels of 16 feet draft of water, the whole of the lighterage at present in-

curred would, of course, be saved, and the towage would very often be saved also, for the reason that the tow-barges proceed on to Quebec in tow with that part of the cargoes required to be lightened down, which obliges us to send the ships in tow also, as we would have either to pay demurrage on the barges whilst waiting the ships' arrival down under sail, or have their cargoes landed at Quebec, thereby incurring an equal or greater expense.

Answer to No. 6—Apart from the expense of lighterage down, it is a great inconvenience to the ships, from the detention it causes, and by increasing the disbursement account from ten to fifteen pounds a day; and such produce as wheat and flour always receives damage and loss by lighterage, and much more so when landed at Quebec. Flour barrels are very subject to lose hoops—have the heads staved—a loss in the weight of flour follows, and the shippers generally find a deduction in their account of sales for short weights; wheat is more subject to damage than flour, and it will always lose in quantity by each transshipment.

It was often the case last season that lighters could not be had, and vessels were detained in consequence for a week or ten days. I would prefer paying 5s. a barrel freight to a vessel taking it in at Montreal, than sending it down to be landed at Quebec and shipping from thence at 3s. 9d. per barrel.

It is my opinion that the freight for lighterage between Quebec and Montreal might be reduced a third in price, and still leave remuneration enough to the tow-boat companies.

Answer to No. 7.—The cost of lighterage down from Montreal has this season, been from a *sixth* to a *ninth* of the full freight of flour from Montreal to the home port, and on wheat from about a *fourth* to a *sixth*.

It will be observed by the statement in answer to the first question, that on two ships in 1839, (the "Canada" and "Arabian",) the difference of towage and lighterage up and down £244 more on the fall than the spring voyage, or 7½d. per barrel on flour on their full cargoes out, calculating their stowage at 7800 barrels; the full lighterage alone up and down in the fall was £306 7 11, or about 7½d. per barrel, and the full towage and lighterage in the fall up and down was £487 3 9, or about 1s. 3d. per barrel of flour.

And on three ships in 1840, (the "Canada," "Glasgow," and "Favorite,") the difference on spring and fall voyage was £339 19 9, or about 7d. per barrel, taking their full stowage at 1200 barrels, the lighterage alone £456 11 3, or 9d. per barrel, and the full amount of towage and lighterage £741 3 0, or about 1s. 3d. per barrel.

The regular trading ships, and a great proportion of the transient vessels, will almost always incur the expense of towage up, notwithstanding any improvement that may be made in the navigation.

(Statement referred to in answer to Question No. 1 in the foregoing evidence.)

STATEMENT OF TOWAGE AND LIGHTERAGE paid by MILLAR, BROMSTONE & ALLAN, in 1839 and 1840, in consequence of the deficiency of water in Lake St. Peter.

SHIP'S NAME.	Old Tonnage.	New Tonnage.	Full Draft.	Draft up.	Balance	Cost of Towage up.	Cost of Lighterage up.	Cost of Towage down.	Cost of Lighterage down.	Draft down.	Draft sailed from Quebec.	Balance from Quebec.	Lighted.	
1839.			Ft in.	Ft in.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	Ft in.	Ft in.			
Canada	329	301	15 0	15 0	.....	85 17 9	0 0 0	41 9 3	0 0 0	15 0	15 0	.....		Came up and sailed in early Spring, when the water was high in the river and the lake.
Arabian	331	330	14 9	14 9	.....	74 12 5	0 0 0	41 2 9	0 0 0	15 0	15 0	.....	
Dryope	341	336	14 10	14 10	.....	76 14 8	0 0 0	44 16 9	25 19 7	14 6	15 6	1 0		
Energy	305	352	14 0	14 0	.....	69 18 0	0 0 0	25 0 0	0 0 0	Went down	Went down	in		ballast to Quebec.
Kilmarnock	282	301	13 6	13 6	.....	56 18 7	0 0 0	0 0 0	0 0 0	Do.	do.	do.		do.
Petrel	231	272	13 6	13 0	0 6	56 19 4	32 9 5	33 8 2	37 19 4	13 6	14 9	1 3		
Cumberland	402	441	14 10	13 0	1 10	71 1 4	77 8 2	30 10 0	0 0 0	Went down	Went down	in		ballast to Quebec.
Canada	323	391	15 0	12 9	2 3	60 14 4	68 16 0	29 14 4	46 9 2	12 9	15 3	2 6		
Kelwick Wood	282	281	14 9	12 6	2 3	56 5 4	55 10 10	25 0 0	0 0 0	Went down	Went down	in		ballast to Quebec.
Arabian	331	300	14 9	12 6	2 3	60 7 6	111 13 4	29 19 8	79 9 5	12 5	15 5	3 0		
						669 9 3	345 17 9	301 0 11	139 17 6					

ANSWERS OF MESSRS. BUCHANAN, CUNNINGHAM & GLASS,
MONTREAL.

Answer to No. 1.—We are unable, at the present moment, to furnish a complete list of the vessels addressed to us in 1839 and 1840; but, for the information of the committee, we subjoin the charges for lighterage and towage incurred by a regular trader of 390 tons in the fall of 1840:

Towage upwards.....	£ 66	5	4
Lighterage upwards.....	122	6	6
	<hr/>		
	£188	11	10
Towage down.....	£44	3	4
Lighterage down....	82	10	0
	<hr/>		
		126	13 4
	<hr/>		
	£315	6	2

Answer to No. 2.—Vessels drawing 16 feet of water are under the necessity, in the generality of years, of employing lighters in passing lake St. Peter for the *whole* of the navigable season, *saving the month of May and a part of June.*

Answer to No. 3.—Vessels drawing 16 feet of water we consider a very suitable class for the trade of Montreal, but still larger vessels might not be objectionable.

Answer to No. 4.—We have no hesitation in affirming that the deepening of the river, as suggested in this query would be followed by the effects contemplated, viz. inducing a greater number of vessels to come to the port of Montreal, and *materially reducing* the rates of freight between the same and the ports of the United Kingdom—indeed we think it cannot admit of doubt.

Answer to No. 5.—We are not prepared to say that if the navigation were so improved, any material portion of the charge for towage downwards would be saved to the trade, inasmuch as we think the regular traders would generally tow for the sake of despatch;—but undoubtedly the whole charge for lighterage would be saved.

Answer to No. 6.—The lighterage, apart from the direct charge for the same, is invariably attended with delay and inconvenience, and with very material injury to the property so shipped; and is consequently very burdensome to the trade.

Answer to No. 7.—We have not sufficient leisure at the present time to give a well considered opinion upon the point proposed in this query, but the following hasty calculation will perhaps serve as an approximation to the true result:—

ARRIVALS AT MONTREAL IN 1839.

Ships,.....	16
Barques,.....	26
Brigs,.....	36
	<hr/>
	78

At an average expense of of £220 each per towage, and
lighterage is..... £17, 160 £17,160

ARRIVALS AT MONTREAL IN 1840.

Ships,.....	11
Barques,.....	31
Brigs,.....	55
	<hr/>
	97

At an average expense of £220 each, is..... £21,340

£38,500

Average per year, £19, 250.

We may add that the arrivals for the present year at Montreal shew a very great increase upon the two past, and the expenses have of course increased in the same proportion.

ANSWERS OF MESSRS. Y. LESLIE & Co., MONTREAL.

Answer to No. 1.—In 1839 the only vessels we entered and cleared were of small tonnage, and neither required towage nor

lighterage; in 1840, the same with the exception of the "Aerial," of 280 tons, towage up, £59 2 8, dues paid by the master at Quebec—no lighterage.

Answer to No. 2.—From two to three months.

Answer to No. 3.—Vessels of the common build, drawing 16 feet water are, in our opinion, large enough for any description of trade to or from the port of Montreal.

Answer to No. 4.—A greater number of vessels would probably frequent the port, and might occasion, by competition, a reduction in the rates of freight, but the expenses of the shipping we do not conceive would be reduced, as the deepening of the channel would not do away with the necessity of towage, and if any tax were imposed upon vessels to pay for the improvements in the river it would increase their expenses.

Answer to No. 5.—The whole of the charge for lighterage would, of course, be saved, but no part of the towage, indeed the latter would be increased by the additional number of feet of water that the vessel, when fully loaded, would draw.

Answer to No. 6.—Yes.

Answer to No. 7.—We have not sufficient data before us to form a correct opinion as to the yearly saving from lighterage, but we would remark that in the summer months, when the water on the lake is lowest, there are, in general, fewer vessels loading at this port than in the spring and autumn. There would, we conceive, be no saving in towage in consequence of the increased depth of water in the channel of the river, but the delay and injury occasioned by the transshipment of property would be avoided. *

ANSWERS OF MESSRS. McINTOSH & Co., MONTREAL.

Answer to No. 1—The vessels entered and cleared by us in the years 1839 and 1840, with the charges incurred for lightérage and towage, as under :—

1839.	Tonnage.	Towage up.	Lighterage up.	Lighterage down.	Towage down	
Ship.....	380	£ 69 0 0	£102 10 0	£30 5 0	£ 32 10 0	
Barque....	284	58 13 0	0 0 0	29 5 0	30 0 0	
Brig.....	196	48 5 4	0 0 0	0 0 0	0 0 0	Sailed down.
Do.	166	55 5 3	0 0 0	0 0 0	0 0 0	Do.
Barque....	204	53 15 3	0 0 0	0 0 0	31 1 3	
Do.	380	72 10 0	43 6 8	22 10 0	35 6 3	
	1,610	£357 8 10	£145 16 8	£82 0 0	£128 17 6	
1840.						
Brig.....	166	£ 47 17 9	0 0 0	£ 0 0 0	£ 0 0 0	Sailed down.
Barque....	305	54 8 8	0 0 0	0 0 0	26 7 3	
Ship.....	444	70 8 0	0 0 0	25 10 0	29 16 3	
Do.	451	72 10 0	0 0 0	33 0 0	35 7 10	
	1,366	£245 4 5	0 0 0	£58 10 0	£91 11 4	

Answer to No. 2—Vessels drawing 16 feet of water are under the necessity of employing lighters to and from Montreal during about four months of the navigable season.

Answer to No. 3—Vessels drawing 16 feet of water are a suitable class for the trade to Montreal.

Answer to No. 4.—If the river between Quebec and Montreal were rendered navigable at low water for vessels of that draught, it would, in our opinion, induce a greater number to come to the latter port, and tend to reduce the rates of freight between the same and the ports of the United Kingdom.

Answer to No. 5.—If the navigation were so improved, vessels would generally sail down, and the whole charge for lighterage would be saved.

Answer to No. 6.—The lighterage, apart from the direct charge for the same, is attended with a delay and injury to property which is burdensome to the trade.

Answer to No. 7.—We should think that the yearly saving to the trade of the province from lighterage, towage, &c., computed as required, would be £4,000 to £5,000.

ANSWERS OF MESSRS. STEPHENS, YOUNG & Co., MONTREAL.

Answer to No. 1.—We are both but little engaged in shipping, and for the years 1839 and 1840 have only cleared some five schooners for Halifax, N. S.

Answer to No. 2.—Ships drawing 16 feet of water can rarely come to this port without lighterage after the first week of June.

Answer to No. 3.—Ships drawing 16 feet of water are a suitable class for the trade of Montreal.

Answer to No. 4.—The deepening of the channel to 16 feet would, in our opinion, induce a greater number of vessels to come to this port, and would cheapen both inward and outward freights.

Answer to No. 5.—Could ships complete their loading at this port, the freight upon that portion sent to Quebec per lighters would be saved, as well as the cost of labor and damage from exposure by transshipment; while the same proportion of vessels would sail down as now do, which we believe to be about one half of the number.

Answer to No. 6.—The lighterage, apart from the direct charge for the same, is attended with much delay and injury to property, and is very burdensome to the trade.

Answer to No. 7.—Though we have not the means of replying to this query so satisfactorily as those to whom ships have been

consigned, and who know the actual disbursements—yet we are sensible that the amount which would be saved to the trade of the Province by the proposed improvement of the navigation between Quebec and Montreal would be very large, and is one of the many improvements on the St. Lawrence necessary for us successfully to compete with the Atlantic shipping ports of the United States for the western trade.

ANSWERS OF MESSRS. GILLESPIE, MOFFATT, JAMIESON & Co.,
MONTREAL.

Answer to No. 1.—A statement herewith.

Answer to No. 2.—Vessels drawing 16 feet of water have to employ lighters from about the 10th June to the close of the navigation.

Answer to No. 3.—Vessels of that draught of water, when otherwise properly constructed, are well adapted for the trade to Montreal.

Answer to No. 4.—We are of opinion that a greater number of vessels would be induced to come to Montreal, which would tend to reduce the rates of freight to a very great extent.

Answer to No. 5.—The towage down would be saved in many cases, and the lighterage in all.

Answer to No. 6.—Lighterage is attended with considerable delay, more particularly felt towards the close of the navigation, when a few hours are of vital consequence to the safety of a vessel, as instanced in the case of the Eleutheria last autumn; it is also attended with heavy expense and frequent damage to property, as in the case of flour.

Answer to No. 7.—We have not the means to enable us to state what the saving would be to the trade, but we think we are warranted in stating it at £10,000, annually.

(Statement referred to in answer to Question No. 1 of the preceding Evidence.)

A STATEMENT (so far as can be procured) of TOWAGE, LIGHTERAGE, &c., paid by GILLESPIE, MORFATT, JAMIESON & Co., in 1838 and 1840, in consequence of the deficiency of water in Lake St. Peter.

SHIP'S NAME.	Tonnage.	Draft up.	Cost of Towage up.	Cost of Lighterage up.	Cost of Towage down.	Cost of Lighterage down.	Draft down.	Date of Arrival at Montreal.	
1838.									
Toronto	351	14 6	£ s. d. 70 8 0	£ s. d. 0 0 0	£ s. d. 0 0 0	£ s. d. 0 0 0	.....	14th May.	
Douglas	377	.....	0 0 0	0 0 0	0 0 0	0 0 0	.....	17th "	
Hants	238	12 0	52 16 0	0 0 0	0 0 0	0 0 0	.....	29th "	
Eagle (schr.)	46	.....	0 0 0	0 0 0	0 0 0	0 0 0	.....	3rd June.	
Leo	230	10 11	47 14 8	0 0 0	0 0 0	0 0 0	.....	9th "	
Erin-go-Bragh	431	15 6	83 2 8	0 0 0	36 18 0	0 0 0	14 0	23th "	
Cœur de Lion	353	.....	90 0 0	103 8 8	26 17 0	0 0 0	10 9	7th September.	
Ladlow	287	11 6	57 16 8	123 10 4	0 0 0	0 0 0	.....	23th "	
Active (schr.)	57	.....	22 17 6	0 0 0	0 0 0	0 0 0	.....	15th October.	
Toronto	351	.....	0 0 0	0 0 0	27 13 0	0 0 0	11 6	20th "	Half towage.
Douglas	377	.....	76 16 0	183 16 6	30 5 0	0 0 0	12 5	25th "	"
Hants	238	11 8	53 6 8	35 0 3	25 13 4	1 8 3	11 5	29th "	"
	3336		554 18 2	445 15 9	147 6 4	1 8 3			

ANSWERS OF MESSRS. ATKINSON & Co., MONTREAL.

Answer to No. 1.—Owing to the shallowness of the lake, we have, for upwards of three years back, discontinued loading vessels at Montreal, considering the expense of towage and lighterage greater than we could afford; such vessels as we had consigned to us we sent to load at Quebec; we had offers repeatedly of vessels to load, both with timber, deals, and other articles, but from the cause above named have invariably declined them.

Answer to No. 2.—We consider that during fully four-fifths of the navigable season, vessels over 12 to 13 feet draught of water are unable to pass lake St. Peter.

Answer to No. 3.—Vessels drawing 16 feet of water are very suitable,—under that, they are only fit for coasting voyages.

Answer to No. 4.—We consider that were the river between Quebec and Montreal made navigable at low water for vessels of 16 feet draught, it would induce fully double the present number of ships to visit the port of Montreal, and that the freights between Montreal and the United Kingdom would be very considerably lowered.

Answer to No. 5.—Were the navigation so improved, one half the ships leaving for the United Kingdom would go down with the wind, without towing, the fear of the water going lower still if too long detained, and of striking, if going a few feet out of the exact channel, causes the greater part to go down by steam. All the lighterage would of course be saved.

Answer to No. 6.—The lighterage apart from the expense, causes very great injury to the property shipped—to flour especially, not only damage to the barrels, but danger of souring.

Answer to No. 7.—We think that were the trade no greater than in 1839 and 1840, twenty thousand pounds currency per annum would be saved in lighterage and towage by the deepening of the channel between Quebec and Montreal as proposed.

ANSWERS OF MESSRS. FORSYTH, RICHARDSON & Co., MONTREAL.

Answer to No. 1.—None.

Answer to No. 2.—From the beginning of June until the close of the season. *

Answer to No. 3.—Vessels drawing 16 feet of water would be suitable to the trade were the proposed improvement carried into effect.

Answer to No. 4.—Unquestionably it would.

Answer to No. 5.—We are of opinion that at least three-fourths of the charge for towage downwards and the whole of the charge for lighterage upwards and downwards would be saved.

Answer to No. 6.—The necessity of lighterage is burdensome to the trade, as besides the direct charge incurred, it creates delay in the shipment, and causes frequent injury to the property from transhipment.

Answer to No. 7.—We are of opinion that the yearly saving to the trade which the proposed improvement would effect is moderately estimated at twenty thousand pounds.

ANSWERS OF ANDREW SHAW, ESQ., OF MONTREAL.

Answer to No. 1.—I enclose statement of vessels entered and cleared during 1839 and 1840.

Answer to No. 2.—After the 15th or 20th June, and until the end of the navigable season, vessels of 16 feet draught of water are generally necessitated to employ lighters in passing Lake St. Peter.

Answer to No. 3.—Vessels of 350 to 400 tons are a suitable size for the trade of Montreal, and such generally will draw 16 feet of water when loaded.

Answer to No. 4.—I am of opinion that 16 feet of water during the season would double the number of vessels in one year, and doubtless tend to reduce rates of freight between Montreal and the ports of the United Kingdom.

Answer to No. 5.—If the navigation were improved to 16 feet at low water, many vessels would not tow downwards, as now the captains generally tow from a fear of being grounded in the lake, as their vessels are almost always drawing as much water as the pilots report on the shoals. Of course all charge for lighterage would be saved.

Answer to No. 6.—Much unavoidable abuse of property takes place from lighterage: on flour alone the injury is serious, both as regards the costs and contents, from rolling and extra exposure,

and much abuse takes place in transshipping in bad weather, from not being under the eye of the merchant. I have little doubt that a great portion of the flour landed sour in Britain is in consequence of exposure in this Province, and much of that after inspection at Montreal. River barges are generally deck loaded, and exposure often takes place in consequence, all which would be avoided were the navigation deepened to 16 feet.

Answer to No. 7.—I cannot answer this question correctly; the lighterage would be almost entirely saved, the amount of towage will, I understand, be ascertained by returns from the steam companies. The expense of towage and lighterage in 1841, will be much greater than in any previous year; in 1840 a very large quantity of flour was of necessity, (from lowness of water,) sent to Quebec by lighters and shipped for Britain, perhaps to the extent of 150,000 to 200,000 barrels, by ship that did not come to Montreal at all. I, as agent, sent 20,000 barrels in that way; in 1841 probably something similar will take place, as there is not at present over 11 or 11½ feet water in the lake. Besides lighterage, there is an expense incurred for Quebec agency.

(Statement referred to in answer to Question No. 1 of the foregoing evidence.)

CLEARED.	VESSEL.	Tonnage.	Towage up.	Towage down.	Lighterage up.	Lighterage down.
1839.			£ s. d.	£ s. d.	£ s. d.	£ s. d.
June —	Ship Bellona.....	389	73 2 6	40 8 2	0 0 0	0 0 0
Sept. 18.....	Bark Monarch...	315	65 4 5	39 0 0	0 0 0	0 0 0
Nov. 4.....	Ship Bellona. ...	389	59 12 4	40 9 4	49 11 0	75 11 3
		1093	197 19 3	119 17 6	49 11 0	75 11 3
1840.						
May 30.....	Ship Bellona	389	74 4 3	40 9 11	0 0 0	0 0 0
June 18.....	Bark Monarch ...	315	64 13 2	38 18 8	0 0 0	0 0 0
Aug. 14.....	Brig Leven Lass.	185	54 9 0	0 0 0	0 0 0	0 0 0
Oct. 12.....	Ship Bellona.....	389	63 3 3	30 12 0	5 15 0	56 1 10
Nov. 15.....	Bark Monarch...	315	63 16 0	33 11 0	0 0 0	42 1 3
		1593	320 5 8	143 11 7	5 15 0	98 3 1

ANSWERS OF MESSRS. DOUGALL, IRVINE & Co., of MONTREAL.

Answer to No. 1.—List of vessels entered and cleared by us in 1840 with their tonnage, and charges incurred for lighterage and towage :

CLEARED.	VESSEL.	Tonnage.	Towage up.	Towage down.	Lighterage up.	Lighterage down.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.
June 2	Five Brothers ...	170	Sailed.	Sailed.	None.	None.
" 26	Victoria	250	63 5 9	33 4 0	None.	None.
July 23	Wanderer	234	54 16 8	Sailed.	None.	A.
Oct. 13	Lord Panmure...	284	47 1 11	Sailed.	None.	32 9 6
Nov. 14	James Dunn.....	394	67 6 8	B.	35 14 8	82 7 5B
		1332	232 11 0	33 4 0	35 14 8	114 16 11

A.—Lighterage down agreed to be paid by shipper would cost £12 to £16.

B.—The sum of £82 7s. 5d. is a block sum for lighterage and towage. This ship having sailed down, but having been booked for towing, had to pay this sum to include both charges.

Answer to No. 2.—Vessels drawing more than 12 feet of water cannot calculate on passing lake St. Peter after the 1st of June, vessels therefore drawing 16 feet can only come to Montreal not later than the end of May.

Answer to No. 3.—Vessels drawing 16 feet when loaded would be the most suitable class of vessels for the trade to Montreal ; this class of vessels can be sailed and towed at comparatively less expense than smaller vessels and can thereby take the bulky exports of this port at much lower freights.

Answer to No. 4.—If the river between Quebec and Montreal were rendered navigable for vessels drawing 16 feet of water, it would certainly induce a greater number of vessels or tonnage to come to this port, and tend to reduce the rate of freights between this and the United Kingdom.

Answer to No. 5.—If the navigation were improved probably a third of the present charge for towage downwards would be saved to the trade, and the whole of the charge for lighterage.

Answer to No. 6.—Lighterage of vessels on the St. Lawrence is attended with much delay and injury to property.

Answer to No. 7.—On the scale of the year 1840 the saving that would be effected by the proposed improvement of the navigation for lighterage and towage, could not be less, we think than £4,000. During that year 40 vessels of from 300 to 450 tons arrived in the port of Montreal, with 98 vessels of a smaller class. Supposing that 30 of this largest class were lightened up and down, 60 tons each, would give £1,500; towage down might be dispensed with by the smaller class of vessels to a considerable extent, and we think on both charges the above saving would be effected.

ANSWERS OF MESSRS. GILMOUR & Co., OF MONTREAL.

Answer to No. 1.—We beg to state that we have no vessels of our own employed in the shipping trade of this port, and have had so few vessels consigned to us that we cannot furnish the particulars as required, but such will no doubt be given fully by those engaged in the trade and more intimately acquainted with it than we are.

Answer to No. 4.—We would remark, that from what we know of the trade, there cannot be a doubt that the deepening of the channel to the extent named, would have a most beneficial effect, as, if this were done, a class of vessels could then be employed well suited to the trade, and whereby lighterage could be entirely avoided; but before much benefit could be derived from this improvement, the harbor must also be rendered capable of receiving vessels of the draught of water named—say 16 feet.

Answer to No. 5.—We do not think the charge for towage of vessels downwards would be much, if any, affected by the deepening of the channel, nor do we think that the number of vessels would be materially increased were the improvement to be carried into effect, but vessels could then leave this port direct for that of their destination with full cargoes, and avoid the heavy charges for lighterage to Quebec of a large portion of their

cargoes (which almost without an exception, is now the case) and which of course would enable vessels to carry at lower freights than at present.

Answer to No.—We regret that we have it not in our power to place before the committee of the House any estimate of the probable saving to the province from lighterage, towage, etc.

EVIDENCE OF W. HALL, ESQ., COLLECTOR OF CUSTOMS, MONTREAL.

Question.—For what portion of the navigable season are vessels of 16 feet draught of water under the necessity of employing lighters in passing and repassing lake St. Peter ?

Answer.—For about five months of the navigable season, vessels of 16 feet draught of water are under the necessity of employing lighters in passing and repassing the lake.

Question.—Can you furnish the committee with any information as to the amount paid for such lighterage in the years 1839 and 1840, and the amount paid for towage during the same period ? If so, state the amount for each service separately.

Answer.—I have applied to the agents of the steam boat companies here for this information, from whom only it could be obtained, and who have promised to give it to me ; as soon as I receive it it shall be forwarded to the committee. (See F.) [Note appendix F. contains ship's name, towage and date of clearance but no amounts charged for the above mentioned purposes.]

Question.—If the navigation of the St. Lawrence between Quebec and Montreal were rendered practicable at low water for vessels of 16 feet draught, would not the whole of the said lighterage be saved and what proportion of the towage would be saved to the trade of the province ?

Answer.—Were the navigation of the St. Lawrence between Quebec and Montreal rendered practicable at low water for vessels of 16 feet draught, the whole lighterage, and at the least four-fifths of the towage down, would be saved to the trade of the province.

Question.—Would the proposed amelioration of the navigation be likely to induce a much greater number of vessels to ascend the river to Montreal, and tend to a reduction in the rates of freight between that port and the United Kingdom.

Answer.—There cannot be a doubt that the proposed amelioration of the navigation will induce a greater number of vessels to come to Mont'real, and will most assuredly tend to a reduction on the rates of freight between this port and the United Kingdom.

B.

Letter from Captain Sandom, R. N., Commanding on Canadian Waters, in reply to a letter from the Chairman of the Committee.

HER MAJESTY'S SHIP "NIAGARA."

KINGSTON, 2nd August, 1841.

SIR,

In reply to your communication of the 30th ultimo, wherein my opinion is requested as to the expediency of rendering the St. Lawrence between Quebec and Montreal navigable at low water for vessels of 16 feet draught, and whether "I think the completion of the work would essentially promote the public service, and what the probable extent of the yearly saving which would be thereby effected in the Naval Department of the Province."

I beg to acquaint you that I have no local knowledge of the navigation in question, but my conviction is, that the Commercial and Maritime interest of the country would be materially benefited by such a work, though I do not consider, under existing circumstances, any saving would be effected in the Naval Department.

I have the honor to be,

Sir,

Your most obedient servant,

W. SANDOM,

Captain Commanding on the Canadian Waters.

TO THE HON. G. MOFFATT,
Chairman "Navigation Committee,"
Legislative Assembly.

C.

*Letter from Commissary General Sir Randolph J. Routh, in reply to
a letter from the Chairman of the Committee.*

COMMISSARIAT, CANADA,

MONTREAL, 4TH. AUGUST, 1841.

SIR,

In reply to your letter of the 30th July, I have the honor to acquaint you that I have never given the subject of your communication any serious or consecutive attention, and which indeed was the consequence of the impressions on my mind, that no well digested plan had been suggested to improve or overcome the difficulties of the navigation which now exist between Montreal and Quebec.

I rejoice to find that the measure has been brought under discussion with a view to its accomplishment, and though I cannot state what would be the saving to be effected, being so subject to the circumstances of the day, and to the transport required to be performed, yet it must be very evident that the convenience would be great in the increased facility for receiving public goods and stores at the head of the navigation, in lieu of landing them at Quebec. The amount of saving would depend on the extent of stores imported, and on this point I could not speak with any certainty unless the committee were to suggest some basis for a calculation.

I have the honor to be,

Sir,

Your very obedient Servant,

R. J. ROUTH, C. G.

The Hon. George Moffatt, M. P. P., Kingston.

**ESTIMATE OF THE EXPENSE OF DEEPENING THE CHANNEL OF LAKE ST.
PETER. BY DAVID THOMPSON, ESQ., CIVIL ENGINEER.**

NOTE.—Original Charts of the St. Lawrence by Mr. Thompson, and doubtless those on which his estimates are based, are in the possession of the Harbour Commissioners.

Expenses, the first season, of two Steam Dredging Machines and Vessels, each of 16 horse-power, to deepen a Channel in Lake St. Peter to a depth of 16 feet, &c., &c.

	£	s.	d.
To the cost of two Dredging Machines, each of 16 horse-power, each in a well constructed vessel, ready to work, each machine neatly hammered, not polished, each £6,000	12,000	0	0
To the cost of 6 lighters, each of 50 tons, at £150 each ..	900	0	0
To 10 cords of pine wood per day for each vessel, or 20 cords per day for both, at 5s. per cord, for 140 days ..	700	0	0
To contingencies	450	0	0
	£14,050	0	0
To wages of 1 Superintendent	450	0	0
“ 2 Engineers, each £150	300	0	0
“ 6 men to each vessel—12 men at £3 10s. per month for 6 months	252	0	0
“ 5 men to each lighter, at £3 10s. per month, for 6 months, being 30 men	630	0	0
For 1 set of hands for 12 hours	£1,632	0	0
To provisions for 45 persons, at 1s. 3d. per day for 6 months, say £3 per day	540	0	0
Cooking utensils, freight, &c., &c.	20	0	0
For 1 set of hands for 12 hours	£560	0	0
<i>Total expense, for the first season, of dredging a Channel in Lake St. Peter.</i>			
To the cost of two Steam Dredging Vessels, complete for operation, 6 lighters, 2,800 cords of wood, &c., &c. ...	14,050	0	0
To the wages of persons employed—1 set at 12 hours per day, £1,632; the second set, do., £1,632	3,264	0	0
To provisions for 2 sets of working persons	1,120	0	0
Contingencies	1,566	0	0
	£20,000	0	0

Expense of Dredging a Deep Channel in Lake St. Peter, the second season.

	£	s.	d.
To the interest on £20,000 currency, at 6 per cent	1,200	0	0
To repairs of the machines, vessels, &c., &c.	500	0	0
To the cost of 2,800 cords of wood, at 5s. per cord	700	0	0
To wages of 90 persons, working 24 hours per day	3,264	0	0
To provisions, &c., for the said persons	1,120	0	0
To contingencies	516	0	0
	£7,300	0	0
<i>Expense of the third year.</i>			
To the interest on £27,300, at 6 per cent	1,638	0	0
To repairs of vessels, machines, &c., &c.	500	0	0
To the cost of 2,800 cords of wood, at 5s. per cord	700	0	0
To the employment of 90 persons, as before	3,264	0	0
To provisions, &c., &c., for the said persons	1,120	0	0
To contingencies	478	0	0
Expense of the third year	£7,700	0	0
Total expense for three years	£35,000	cur'ncy.	

If a powerful steam dredging machine, similar to the two vessels now employed at Ballnagher, in Ireland, were brought into operation, Lake St. Peter would be deepened to the above extent and depth in less time than two open seasons, and the expense diminished to less than the present estimate of two years by at least one-fifth of the sum.

DAVID THOMPSON.

This report on the petition of the Board of Trade of Montreal seems to have been favourably received, as appears from the following reference in the Report of the Board of Works for 1841, stating that an appropriation for the improvement of Lake St. Peter was inserted among the estimates:—

Extract from the Appendix of the Journal of the Legislative Assembly.

REPORT OF THE BOARD OF WORKS, 1841.

The improvement of lake St. Peter for deeply laden sea going vessels, is a subject also of very great importance, and has occupied the serious consideration of the Board of Trade of Montreal, who have petitioned the parliament for an appropriation to fit out the necessary establishment of dredging vessels etc., and they propose a tonnage upon the vessels trading to the Port to pay the interest on the outlay.

The Governor General will perceive that this proposed appropriation is inserted among the estimates, see Appendix ; but it is very desirable that a sum, say, £1000 should be at once made available to make some alterations to the steamer belonging to the Harbour Commissioners, so as to have the nature of the work fully and practically tested, prior to any large expense being entered into.

It is of interest in connection with the discussions of the present day, as to how the expense of improving the channel should be borne, that in the early agitation of the scheme, all the proceedings of the Legislature, and of the Montreal Board of Trade, show that the deepening was looked upon entirely as a work of public utility, to be carried out and paid for by Government. Nothing else seems to have been thought of, and the surveys and execution of the work were handed over to the Department of Public Works as a matter of course.

The greater economy with which the Atlantic trade could be done with the largest vessels of the day, instead of the smaller, was clearly recognized by the merchants who gave evidence before the Special Com-

mittee of the Legislature in 1841, and it was held that the larger vessels, for the sake of economy, should be brought up as far as possible, *i.e.*, to Montreal.

For these reasons, and to enable the St. Lawrence successfully to compete with the United States Atlantic ports, the deepening of the Ship Channel was urged.

Actual operations soon followed this petition of the Board of Trade of Montreal, and the report thereon of 1841, for we find by the following report of Chas. Atherton, Esq., Engineer, &c., of August, 1843, that the channels had then been examined.

Mr. Atherton distinctly recommended the work of improvement to be applied to the old or crooked channel. His advice was not followed, however, for we find in the following report of the Board of Works for 1843, and in Mr. Begley's letter of 20th October, 1843, that the Board, at that time, had not come to any decision in the matter. In January and February, 1844, Mr. Killaly communicated with Captains Bayfield and Douglas in regard to the work about to be begun in Lake St. Peter, and received from them answers favouring the selection of the straight channel, but we must wait for an explanation until we gather it from the evidence taken before "The Select Committee to whom was referred that part of the report of the Chairman of the Board of Works which refers to Lake St. Peter."

This evidence, taken 15th to 30th May, 1846, shows that the straight channel was adopted virtually by Mr. Killaly, for we find that the chief advice received by him respecting it was from Captain Bayfield, whose opinions were avowedly based on Mr. Killaly's representations. (See Report of Board of Works, pages 65 to 69; Mr. Killaly's and other evidence, pages 137 and 149, and Captain Bayfield's report, page 154; also Report of Select Committee, page 113.)

In this evidence we also find that a few days' work (two or three) was done at different times in the old channel, late in the autumn of 1843, merely as tests of the machinery, though the Superintendent, Mr. Atherton, evidently expected the work to go on there, as it appears the old channel was buoyed out with that view. (See Mr. Killaly's evidence, pages 143-8, and William Hunter's evidence, pages 121-2.) From the evidence of Hunter and others taken before the Select Committee, and from the report of the Board of Works, we gather that work was regularly begun in the straight channel in the spring of 1844.

About this time the question of Channels was hotly discussed. In the following extracts, correspondence, newspaper reports of Parliamentary debates, and reports of Committees, will be found an account of the beginning of regular work in the straight channel in the spring of 1844, its continuance until its suspension on the 8th of June, 1846, its resumption in the fall of the same year, and its final suspension on the 16th of September, 1847.

REPORT ON PROPOSED PROCEEDINGS IN LAKE ST. PETER.

BY CHAS. ATHERTON, Esq., Engineer, &c.

August, 1843.

T. A. BEGLEY, Esq.,

Secretary, Board of Works.

SIR,

I have the honour respectfully to submit my further report on the Lake St. Peter Works, now about to be practically entered upon. I also beg to submit Bayfield's Chart of Lake St. Peter with the proposed line of operations delineated thereon. The Board are in possession of other surveys, but it is necessary to fix upon some one survey as the Map of Reference, and it is my duty to recommend that Bayfield's be taken for that purpose. This Chart, from *all the points* that have come under my observation, *I believe to be admirably correct*, and it sets forth the Hydrography of the Lake *more fully and satisfactorily than any other document* which I have met with.

On the general subject, my previous correspondence has already apprised the Board that in my opinion, the only means of attaining the object in view, a passage for deep draught vessels, is by selecting the existing channel, *tortuous as it is*, as the line of operations, limiting our works to the dredging of a *narrow* cut, I may call it a sunk canal, and the erection of Beacons and lights, whereby the improved channel may be indicated by day and night; *each season's operations* to be in a degree beneficial throughout the whole line, and affording a test whereby the propriety of further expenditure may be determined. But on the present occasion of final decision the Board may be desirous of having before them the various views which have been promulgated, and I may briefly adduce the reasons which have led me to recommend a strict adherence to the improvement of the old channel, in preference to adopting other plans which have been brought forward into public notice.

1st. It has been proposed to form a straight channel through the lake shown by a red line (A B), taking advantage of the stretch of a pool of 13 feet water, which extends from off the mouths of the river St. Francis into deep water at Pointe du Lac.

I cannot concur in this project, because it involves the necessity of cutting through the *main body* (not clipping off the extremity) of the St. Francis Bank, which bank extends out into the middle of the Lake opposite Rivière du Loup, thereby causing the present detour round the upper light. The width of the Bank to be cut through would be about $2\frac{1}{2}$ miles. The greatest extent of dredging that can reasonably be contemplated is comparatively too insignificant to divert the flow of the waters of the St. Lawrence, consequently nature might again, in all probability gradually restore the bank to its present condition; and, after all, the channel thus proposed to be attained by cutting through the St. Francis Bank, gives only from 12 to 13 feet water, and would therefore require dredging over a further extent of about $8\frac{1}{2}$ miles, before it meets the 15 feet water opposite Machiche.

2nd. It has also been proposed to close several of the minor channels between the Island at the head of the Lake, thereby throwing the whole waters of the St. Lawrence into one body, in expectation that a channel would be formed and preserved by the action of the water.

I cannot concur in this view, for although it be granted that the main body of the St. Lawrence might be confined to one of the main channels, still the scouring effect thus produced would be lost as soon as the water would have liberty to spread, and a shoal would undoubtedly be formed where the scouring effect ceases.

3rd. Another Plan has been the constructing of a Dam across the outlet of the Lake near Pointe du Lac, whereby the surface of the Lake may be raised to such height as may appear necessary for the purposes of the navigation.

Even admitting that all this were effected, the lake would be converted into a sort of cesspool, having a gradual tendency to equalisation throughout.

These divers opinions being thus disposed of, it becomes my more immediate duty to submit more particularly in detail the course of operations intended to be pursued. Referring to the Chart (Bayfield's) I have shewn therein the ordinary course of deep-draft vessels by a black dotted line..... Following this course it will be observed that the navigation is *very intricate at the Buoy (F)* about a mile above the upper light: the difficulties here are occasioned by mere protrusions, the bank of which will be easily removed by dredging.

From the upper to the lower light, a distance of nearly three miles, there is a good channel: this channel appears to constitute the natural confluence of the waters of the St. Lawrence after being disposed of among the islands at the head of the Lake.

After taking a turn at the Lower Light, called the Little Traverse, the long flat commences, giving only 11 feet water (six inches less occasionally, according to the season) for a distance of *about 2 miles*, and subsequently 12 to 13 feet for a space of about 5 miles, then suddenly deepening into 15 feet water opposite River Machiche. This shoal ground, extending *about 4½ miles* from the lower Light to Point (D) nearly south of Machiche Church, which we may call Machiche Point, may be said to comprise the main labor to be encountered. It is proposed that operations be first commenced on the 11 feet flat by dredging through it a channel down to 12 feet. This locality being in the very middle of the Lake, in which a channel 100 yards wide is comparatively a mere line on the Plan, it is evident that the operation of dredging would be interminable unless arrangements be made by means of leading lights whereby the line operated upon may be accurately indicated. To effect this it is proposed to move the present Lake Lights at A and B, and establish a third light at (C), the location of C being such that the lights C and A when kept in line shall indicate the course of the improved channel, over the long flat from A to D. It is also apparent that C may be so located in the line D A (projected) that the light C ranging with the upper light B, may also indicate the line of operations on the channel B F. It moreover fortunately occurs that the line of the lights A, C, projected towards the Berthier channel will clear the shoal point X at the entrance thereof,

thereby subserving the useful purpose of facilitating the entrance to the Berthier Channel, independent of its essential utility as a Lake light.

After the dredging operations on the lines A D and B F shall be completed, the deepened cut will be available only in proportion to the accuracy with which the lights A, B, C, shall be stationed; it will therefore be highly desirable that piers be established at these points as well as at the point D. For the present, however, whilst the lake dredging is confined to the line A, D, a signal station is proposed to be erected on shore at E, by which the line of operations will be regulated. It may be advisable that the success of the lake works be established by experience on the line A D, before the expense of permanent piers at A, B, C, be incurred.

By the Plan of operations thus proposed the extent of work required to produce a given result will be as follows:

At present, the ordinary summer level limits the draft of vessels to 11 feet.

An improvement to the extent of one foot, giving a channel 12 feet deep, would be obtained by dredging one foot over a space of about 2 miles in length, and supposing the required width of the channel to be 100 yards, the quantity of soil to be dredged would be about 120,000 cubic yards.

A further improvement to the extent of one foot giving a channel 13 feet deep, would be obtained by the additional dredging out of one foot over a space 5 miles long, amounting to 200,000 yards.

Total quantity of dredging, $120,000 + 200,000 = 320,000$ yards.

A further improvement to 14 feet water, would be obtained by the additional dredging of one foot over a space of about $6\frac{1}{2}$ miles, amounting to about 280,000 yards.

Total quantity of dredging $320,000 + 280,000 = 600,000$ yards.

The channel in all cases being presumed to be 100 yards wide.

It is also necessary to remark that almost simultaneously with the lake work, a small extent of dredging will be required at Lavaltrie—the river improvements, however, will be more conveniently embraced in a separate report.

I have the honor to be, Sir,

Your very obedient Servant,

CHS. ATHERTON,

Supp. Eng. of the Lake St. Peter Improvements.

Extract from Report of the Board of Works, 1843.

LAKE ST. PETER.

NOTE.—This Report appears to have been made by Mr. Killaly.

Considerable and unforeseen delay has taken place in commencing the operations of this important work, the occurrence of which the Board very much regret, and had no reason to have anticipated. As soon as well could be, after the passing of the appropriation for this work by the Legislature, the Board instructed the engineer appointed for this service to prepare and forward such documents as were necessary to enable them to agree for the several boats, machinery, &c., and without loss of time the contracts were entered into for the construction of most of them.

These contracts, with a view to ensure expedition, were parcelled out among the most respectable shipbuilders and founders; but in the prosecution of sundry details, necessary to their completion and outfit, the engineer was induced to make arrangements with other parties, securing thereby, as he conceived, their being furnished with the least delay. It, however, turned out otherwise; mistakes occurred in making the models in the different shops, the parts did not correspond, and a large proportion of the work so prepared was rejected, and had to be re-made at the cost of the contractors. This circumstance, together with the disappointments which usually take place in such expensive outfits, have prevented the dredge and other establishments from being ready early in the year, as the Board were led to expect, and the season is now so far advanced as to render it imprudent in their judgment to attempt more than to test the powers of the several vessels, and prove experimentally in two or three places the nature of the bottom to be dredged, and ascertain with as much certainty as possible the rate at which the work can be made to progress with our own equipment.

Having thereby ascertained the precise value of the work, the Board would be enabled to engage such other dredging vessels by contract, as the proprietors may be disposed to employ in this service.

Extract of a Letter from Mr. Begley to Mr. Atherton, dated Kingston, 20th October, 1843.

"I am instructed to acknowledge the receipt of your letter, received here on the 6th instant, and to make the following observations thereon upon points as they arose in the mind of the Board in the course of perusal.

"The Board conceive, from the very late period to which unfortunately your commencement was protracted, that the work this season should be extended to very few days more, so that the entire of the vessels may be laid up on or about the 1st November, at Sorel, and the establishment got rid of. The Board, upon receiving your former letter fixing on the line of dredging as considered most advisable by you, were of opinion that from the reason already stated (viz., the lateness of the season) it was impossible with advantage to do more this year than test the several boats, machinery, etc., etc., and also ascertain partially, by a few days' dredging, the nature of the bottom and the effect of machinery upon it as to power and quantity in two or three places. This they are most anxious should be done yet, taking care, however, to have the vessels laid up by the time stated; but as to the line of future operations they are by no means yet informed sufficiently to decide so very important a point, especially as the South Channel appears to them not yet to have received that consideration which the direction of its course and general depth of its water appear to entitle it to.

"With this feeling, the Board propose, during the interval between the present and the opening of the working season next spring, to collect from all quarters where knowledge of the Lake and other requisites may appear to them to exist, the fullest advice and information, by the general result of which they will be guided in their decision as to the Channel to be adopted."

The following is the correspondence between Mr. Killaly and Captain Bayfield, in January and February, 1844, before dredging was regularly begun, also between Captain Douglas and Captain Vaughan :—

Mr. Killaly to Captain Bayfield.

[COPY.]

MONTREAL, 25th January, 1844.

SIR,

The importance to Canada of the results (if favorable) of the operation of an extensive dredging establishment, prepared to be put to work on the opening of navigation on Lake St. Peter, will, I trust, plead my excuse for thus bringing the subject under your consideration, with the view of having the benefit of your opinion thereon. The great weight and respect to which I consider that opinion entitled, from your experience and intimate acquaintance with the Lake, as evinced by the very minute Chart made by you, (the perfect accuracy of which is fully confirmed by the various soundings and observations that from time to time I have had made,) impels me, although not having the honor of your acquaintance, to request that you will take the trouble of communicating to me your views on the subject.

Fearing accident or delay by post at this season, I have thought it better to send the bearer, Captain Vaughan, down to you specially, as he will be enabled to explain fully to you my own views, as well as the objections which I entertain against those of others.

I have been informed, whether truly or not I cannot say, that your opinion was adverse to the work, fearing the establishment of a more capacious channel, by facilitating the discharge, would operate injuriously upon the river above. I admit I have approached it not without some hesitation, and I have therefore been very careful in so arranging the expenditure and dimensions of the vessels as to render all available on the river, lakes and harbours above Montreal, where much work of this description is required, and I also propose proceeding cautiously with the work on the lake, by which I hope to avoid the risk of injuriously affecting the river in the manner alluded to.

In the outset, I find myself differing as to the line of channel with the gentleman to whom was entrusted by my Department, during the past year, the carrying out of the necessary preparations. He proposes to follow the old channel, as marked by a blue line shown on a trace which Mr. Vaughan brings down with him, and which is taken from your chart. This very circuitous course, with more than one bad turn, I conceive, will every year be found more objectionable and dangerous, in proportion as the trade and employment of fast steamers increase. Frequent collisions take place annually, and on comparing this channel with the direct one marked on the trace in red, I find the quantity to be removed in the latter, (to obtain, say, a fourteen feet channel,) but little more than what would be necessary in the crooked one. This direct channel, with at present, in low water, about 13 feet, is only obstructed at the upper end, and I am disposed strongly to think that, by removing this obstruction, the set of a larger proportion of the discharge of the river waters directly down it, would tend effectively to keep it open. Should it be found that the discharge is not sufficient to keep open *two* channels through the lake, I would expect that the circuitous one will be that likely to be affected by deposits, and that by carefully observing the effect of the work, and governing it accordingly as to breadth and depth, that without injuring the navigation above, the great benefit of a perfectly direct channel *at all events* can be had, whereby risk of collision, cost of lighting and of pilotage, would be materially lessened. From the calculation I have made, however, I am induced to the conclusion that a channel 15 feet in low water may be ultimately obtained; but in such a case as the present, I am far more inclined to judge and be guided by experience obtained during the progress of the work than by any calculation founded on theory.

The Legislature having decided on the experiment, the question to which I respectfully solicit your attention, therefore, is as to the channel which, in your judgment, it would be most expedient to adopt. The plan proposed as to the deposit of excavated stuff, as well as the line in which it is to be laid down, (see trace,) I am also disposed to differ from. Forming, as it would do, a kind of pier or bar, and extending more than one-third across the lake, I conceive it would create a new direction

of the current immediately; that this would at once affect the channel, and throw it by another bend more towards the north shore. From the present current and prevailing winds, the deposit appears to take place on the south shore, catching on all the jutting points. The effect which would be produced on this inclination to deposit, by the bar already alluded to, and found by the excavation, is obvious, I conceive.

As stated, my idea would be, first, to obtain a direct channel of moderate breadth, and 12 feet depth throughout, and subsequently to be governed, in adding to its depth and breadth, by circumstances. The facility that exists for directing a column of water from two or three of the present channels into the new one is, I think, also much in favor of adopting the straight channel.

Since I have formed my own opinion on this subject, I have taken much pains to collect those of the pilots and others acquainted with the lake, the greater number of whom appear, as far as I can learn, to support the conclusion I have come to; but I feel most sensibly the importance of having the benefit of your science and practice upon this most interesting subject. I have not considered it necessary to go more into detail, as Capt. Vaughan can fully explain my views, and from his intelligence and long acquaintance with the lake, I consider his opinion highly deserving of attention.

I beg to subscribe myself, Sir,

With esteem, your obdt. servt.,

H. H. KILLALY.

Captain Bayfield,
&c., &c., &c.

Captain Bayfield to Mr. Killaly.

[COPY.]

CHARLOTTETOWN, PRINCE EDWARD ISLAND,
12th February, 1844.

SIR,

I have received your letter of the 20th January, by Captain Vaughan, whose early departure to-morrow morning, (that he may avail himself of the mail, the only conveyance across the

Strait), leaves me but little time to give you the opinion which you have done me the honor to request. But although my written communication must thus be necessarily brief, yet I have explained my views fully to Captain Vaughan, and feel that I can rely on his intelligence to explain them to you on his return.

Indeed, I agree so nearly with the views which you have communicated to me in your letter, that there remains little more to do than to express my concurrence therein.

My opinion has never been decidedly adverse to the attempt to deepen Lake St. Peter, as you have been informed; but I have always viewed it, and still do view it, as a work of too great magnitude, importance and difficulty, to be lightly undertaken, or proceeded in without all the cautious regard to the effect of the work as it proceeds, on the navigation of the river, above and otherwise, which you have so well expressed.

I quite agree with you that the old channel shown by the blue line in the trace, should be abandoned and the attempt made in the direction indicated by the red line, because it would only require about two nautical miles of excavation in the upper part of the proposed channel to give it a depth of from 12 to 13 feet at ordinary low water, if the depth has not diminished since our last survey; and even if the advantage gained should be limited to the attainment of a depth of 12 or 13 feet in a direct instead of a circuitous channel, the benefit to the navigation would, I conceive, be very great. But it would require no less than five miles of cutting by the old route, and nine miles by the proposed new and direct channel, to obtain a depth of 14 or 15 feet, either of which, I confess, appears to me a herculean task. Whether, if it were performed, the channel would not be constantly filling up with mud and sand, is a question which experience only could answer. Much will depend on the practicability or otherwise, of diverting any considerable portion of the main stream from the old and circuitous, into the new and direct channel; for there is little doubt, I think, that if a current can be formed, it will tend to keep the channel open for some distance down, although it might cause a deposit lower down the lake, which might have to be, from time to time, removed.

The plan proposed for the deposit of the excavation stuff, as *shown in blue on the trace*, is, I think, very objectionable. It

would, without doubt, direct the current over to the northward so as to form a new bend in the channel. I conceive that the deposit should be made parallel to the south shore of the lake, below the River St. François, and as close in shore as possible.

The smaller channels between the islands of Lake St. Peter appear to be in progress of filling up, and as it is desirable to direct as much water as possible into one main channel, I conceive it would be desirable to assist that process; but on this and minor other points, I must, for want of time, refer you to Captain Vaughan for my opinion.

He will also explain to you the route which I think should be adopted so as to pass the dangerous shoals at the foot of the lake, of which I have sent you a trace.

You are, no doubt, aware that there is very little more water over the bar of Lavaltrie than over the flats of Lake St. Peter. The obstruction consists of large stones embedded in clay, but is of small extent in comparison. I am, however, in hopes that this may be avoided altogether, by following a narrow but deep and direct channel close along the north shore, from Lanoraie up to Lavaltrie, passing between Lavaltrie Island and the main, as will be explained to you by Captain Vaughan, and as shown in the trace copy of the original survey which we have hastily made for your information.

I send, for your acceptance, three of the approved sheets of our survey of the St. Lawrence, from Montreal downwards. They have been so reduced in scale as to be of comparatively little use in many parts, but they may serve to give a general idea of the channels and shoals; and if you should wish a trace of any part of the river on a larger scale, I should have much pleasure in sending it to you.

Believe me to remain,

Sir,

With much esteem, your obd't. servant,

(Signed)

HENRY W. BAYFIELD, Capt.,

Surveying the Gulf of St. Lawrence.

To Hamilton H. Killaly, Esq.

Chairman Board of Works.

Canada.

Captain Douglas to Captain Vaughan.

STEAMER "UNICORN,"
HALIFAX, February 17th, 1844.

MY DEAR VAUGHAN,

According to your request, I lose no time in giving you my views on the question of cutting a straight channel through the Lake St. Peter, as shown by tracing copy of Captain Bayfield's survey. I was with the "Gulnare," and under the command of Captain Bayfield, R.N., when that survey was in progression, and subsequently in command of a steamer (the "Canada") for nine years, and was always of opinion that the present contemplated cut, as shown in tracing copy from Captain Bayfield's survey, as marked in red ink, was the only one that would give a satisfactory result, and I have no hesitation in recording now my unchanged sentiments on that subject.

And remain, dear Vaughan,

Yours very faithfully,

(Signed,) WALTER DOUGLAS.

The following is the correspondence between Mr. Killaly and Captain Bayfield and others during the progress of the dredging in the straight channel, and the Governor-General's reply to the address of the Corporation of Montreal:—

Captain Bayfield to Mr. Killaly.

[COPY.]

"GULNARE," AT CHARLOTTETOWN, P.E.I.,
1st June, 1844.

DEAR SIR,

I beg to transmit to you a copy of a letter which I have just received from Captain Beaufort, the hydrographer, in which he expresses his own opinion and suggestions respecting Lake St.

Peter, as well as those of J. M. Rendel. They do not differ much, if at all, from your views or mine, but thinking, nevertheless, they might interest you, I send them by post.

Copy of Captain Beaufort's Letter.

"DEAR CAPTAIN BAYFIELD,

"I sit down to answer your letters of the 9th and 26th April, and though the latter concerns more immediately my great work, yet the former is of such leading interest that I might begin by Lake St. Peter.

"A civil engineer of considerable eminence, J. M. Rendel, came in whilst I was reading it, and we have discussed the affair with all the earnestness due to an operation so generous and praiseworthy in the conception, and so big with future importance in its issue.

"It is obvious that the cause of the channel taking a northerly twist, is the action of the two rivers Yamaska and St. Francis; that the first impression on the mind is, adhere to that channel, act in concert with Dame Nature, and she will assist you. But on further reflection, he and I are convinced that the safe and sure process will be to make an artificial groin, from the point A in the direction of the south channel, so as to direct the streams of the two rivers above mentioned and the main stream into it. This groin he proposes to form by a few piles from the adjacent woods, by wattling, if requisite, and by depositing there all the heavy part of the materials which you dredge up. To divert still more effectually the water from the alien channels it has taken between the islands, some attempt might be made to deposit mud, &c., in their necks, and if that is not practicable, the streams of some of those channels might be deflected towards the new channel by groins similar to the above one, as at B and C, &c.

"After your groins are formed by the product of the dredging machine, he would urge you to dredge no more, but to *rake*, and to leave the current to carry off the silt thus loosened and stirred up. The rake has been tried with very happy effects at Liverpool, where an 11-foot channel has been partly formed and suc-

cessfully preserved by that instrument.* That employed by Captain Denham, and now used by Mr. Lord, is like an iron harrow, but Mr. Rendel thinks a chequered chain, one with deep teeth at every intersection, would take the lie of the ground better and work better, but this will be a matter of experiment. The enterprise cannot be in better hands than in Mr. Killaly's, and I shall be very much obliged by your telling me, from time to time, about his proceedings, and, I trust, about his success. I take it for granted that he will try his tools and initiate his workmen upon the upper bar of Lavaltrie, before he attacks the lake, and if the distance be not too great for the dredging tug, it would be a good plan to throw what is brought up between the islands, and thus strangle some of those channels.

"If I can be of any use to Mr. Killaly, in procuring either books or opinions, pray tell me.

"Very truly yours,
(Signed)

"J. BEAUFORT."

I am in too great haste to comment upon Mr. Beaufort's letter, but I trust you will have the kindness to enable me to tell him of your proceedings from time to time, as he wishes, and I unite with him in wishing you every success. You will not, I hope, hesitate in availing yourself of the offer contained in the last paragraph of his letter, if it can be of any use to you.

Believe me, dear Sir,
Yours very truly,

(Signed) HENRY W. BAYFIELD.

To the Honble. H. H. Killaly,
&c., &c., &c.

Mr. Killaly to Captain Bayfield.

BOARD OF WORKS OFFICE,
MONTREAL, 27th November, 1844.

DEAR SIR,

Very many thanks for your kind letter of the 1st June last, and I would beg you to believe I am duly sensible of your valu-

able communications upon the subject of that (now to me) most interesting work, the effecting of a direct channel through Lake St. Peter, with an increased depth of water. I fear you must have set me down as undeserving of the trouble my letters respecting it had put you to from my long silence, but the fact is I deferred from day to day writing to you until I could give you, not *opinions*, but a statement of *facts*, and communicate to you the result of our season's operations. I was the more anxious to do this, as no doubt, on Captain Douglas' return from this quarter of the country, he made you acquainted with the diversity of opinions which prevails here, respecting, *first*, the possibility of effecting anything; *secondly*, the extent of the probable improvement; and, *thirdly*, the propriety of the course adopted. For my part I was perfectly satisfied, after much thought, that whatever is to be accomplished must be in the straight channel, and that the obtaining of a moderately increased depth of water, and of a direct course instead of the present very crooked one, were advantages certain to be derived from and sufficient to justify the experiment.—I have not been so presumptuous as to declare to what extent an increase of depth can be obtained, and I have taken good care that the outfit, (which constitutes three-fourths of the past expenditure,) is such as to be applicable to the improvement of the several portions of the upper navigation, and of the harbours on the lakes which require it. From the very nature and magnitude of the work, practical men would be cautious and slow in coming to a decision, but in such cases, where, as I conceive, *experiments* in conjunction with theory and science, must be resorted to, before any final and satisfactory conclusion can be arrived at, were they to be deterred from having any recourse to it by unfavourable predictions, always plentiful on such occasions, and often emanating from very ill-informed sources, many of our noblest existing works would never have had being.

Under all circumstances, you will easily imagine my gratification, I will say ease of mind, at having my own views sanctioned and strengthened by the scientific and practical observation of such men as Captain Beaufort, Mr. Rendel and yourself.

In a country situated as this is, no work can be embarked in without affecting directly the individual interests of several, and

holding the position I do, I have much opposition and misrepresentation accordingly to encounter.—In the present instance all the proprietors of barges for the lightening of the vessels up to and down from Montreal, the steam-tug proprietor, some of the pilots, but especially the Quebec interests, are “at war to the knife” with the project of effecting the channel.—They will, no doubt, endeavour, during the approaching session of the Legislature, to throw every obstacle in the way they possibly can, and I am sorry to say the opinions of Captain Boxer, much too freely given, (in my judgment,) after a very cursory examination, *en passant*, without any previous knowledge of the lake, its channels, directions of its currents, their rates, the influence of the rivers discharging into it, &c., &c., will appear to give weight to the views of those who oppose the project. Whatever Captain Boxer’s merits may have been before Acre or in such service, (and I dispute them not), they do not, in my estimation, entitle his opinions, formed so hastily, and without any previous detailed or personal information, upon a question involving so much scientific as well as practical knowledge, to pass current. The station and acquirements of Captain Beaufort and Mr. Rendel, impress at once a standard value upon *their* suggestions and opinions, and I assure you, on reading the portion of Captain Beaufort’s communication, quoted in your letter, I felt proud and happy at finding the course I have taken so much in accordance with their views.

I have ever been an advocate for following and acting in concert with “Dame Nature,” especially in *water* operations; it was not, therefore, without a great deal of consideration that I took the direct South Channel. I need scarcely repeat to you the reasons for so doing. The power of diverting such a mass of water down it—its being capable of being easily made perfectly straight—the only obstructions in it being at the head, where we can bring the force of the St. Lawrence directly to bear on them,—the great facility of our working in it, compared with the present circuitous channel used by the trade, in which our vessels, leading chains, mooring cables, buoys, anchors, attendant lighters and tenders would be constantly in the way or getting foul of the vessels passing at all hours. The same reasons, or very nearly so, appear to have weighed with you and Captain Beaufort, in

coming to the same decision as to the channel to be taken. The results of our operations this year are so satisfactory, and so much beyond what I had calculated on, that I do not hesitate to express to you my conviction that success is certain and will be speedy. I send herewith a section shewing the state of the work at the commencement and termination of the past season. It is formed from soundings taken most carefully by Captain Vaughan, our superintendent of the work, in connection with Captain Rayside, the Harbour Master and Chief Officer of the Trinity Board of this city. Of the experience and capabilities of both these gentlemen, you are, I believe, fully aware. The soundings were taken on the 19th of the present month, on a calm day, and with a pole marked into feet and inches. As the bank stands at its original height on each side the channel, and the depths in it speak for themselves, there can be no mistake whatever in the matter.

Our apparatus in the commencement of the season was deficient in several respects; so much so, that, from the many unavoidable interruptions, I consider we in reality worked not much more than half a season; yet the results, I am sure, you will consider far greater than you would have calculated upon. By taking the most moderate measurement of the quantity which has disappeared, and comparing it with that which the united loads of the number of barges discharged daily, during the working season, (and of which a regular log was kept,) would give, it is *certain*, that the quantity carried off by the current is *equal to that absolutely lifted*. The current has obviously and seriously been increased. On commencing work a man sculled across the channel easily with one hand. It now requires stiff pulling to get across it without drifting much. Most of the rafts which used to be carried round the North Channel, are now brought down the direct one by the strength of current, much to our annoyance, carrying away our moorings, getting foul of our vessels, &c., &c. The original buoys we put down to mark our locale, and which floated well up, are now under water from the same cause.

Not only had the dams and the groins, suggested in Capt. Beaufort's letter and referred to in that I had the pleasure of receiving previously from you, been decided on, but the mode of their construction. I had directed that the piles should be cut away

at low water, or a foot under it, so that the River, on the "break up," would float the ice over them, and I had instructed Capt. Vaughan to have "wattled on" among these piles, trees (branches and all.) The stuff excavated has also been deposited, according to Capt. Beaufort's idea, namely, in stopping up the mouths of the alien Channels, the result of which the greatly increased current in the direct channel fully shows; and to the effect of a rake which I have had briskly at work, I attribute the disappearance of so great a mass of stuff beyond that actually taken up. The chain harrow of Mr. Rendel is a good idea. The one we use assimilates to it much, as, from being in joints, it accommodates itself to the irregularities of the bottom. The dredges left a number of ribs in the bottom of the channel of from 1 ft. 6 in. to 2 ft. 6 in. in height, which the rake has prostrated. So far as I can form an opinion the nature of the stuff is of a fortunate consistency. Sufficiently tenacious not to threaten silting up, and yet capable of being raked up and carried off by the stream.

You are aware that the ice on the great surface of the lake becomes grounded on the shoals, I expect much to be effected by this operation also, as the passage of a large portion of the waters of this vast river, instead of being diverted as heretofore into several small and crooked channels, will take place down the new and straight one, and I calculate therefore that considerable under-cutting will take place. This, I have observed, occurs in the several second class rivers in the Province, wherever the bottom is not rock. The main groin, to throw the united volume directly down the new channel, we cannot complete until the channel is available to the trade.

When the channel is created, my idea is to construct at each end an isolated substantial pier, with a light-house on each. These, together with the straightness of its course, will enable it to be used at all times, and I have no doubt the constant passage of the steam vessels will much aid the stream in the keeping clear and dressing of the channel.

Our outfit consists of two steam dredges with two engines and one chain of buckets each, working in the centre of the boats; also two steam-tug vessels; one of these is employed constantly at the scows, in which the other only assists, but when not so employed she works the rake. I am inclined to believe that we

may be compelled to get a third, for if the dredges work as well next season as they did towards the conclusion of the past one, the services of the two tug-boats would be required at the scows. We have but one rake, but I will have another made this winter, there being many days during the season when, from the roughness of the lake, the dredges cannot work, but the rakes could be used to advantage. The discharging scows, fuel and attendant lighters compose the remainder of our squadron.

I will now hazard, for your consideration, my ideas generally upon the lake, and the reasons which induce me strongly to entertain the impression that when the channel is once opened it will continue.

I agree fully with Capt. Beaufort and Mr. Rendel, "that the "obvious cause of the present 'Northerly' twisted channel has "been the effect of the action of the two rivers, the Yamaska "and St. Francis,"—but as the course of this channel is not that which the resolution of the respective forces of those two rivers combined would, under ordinary circumstances, have been able to establish, so much is it across the line of the greater stream of the south branches of the St. Lawrence; and keeping in view the fact of the existence of the comparative wide and deep direct channel from the east end of the lake up to the confluence of those rivers, I am disposed to consider that, at a former period, *both* the north crooked channel and the south direct one existed—the former kept open chiefly by the stream of the St. Lawrence passing through the islands; but that the main channel was the direct one, and that its waters being diverted or turned off into the former, which they now follow, was owing to the effects probably of an unusually heavy and early "break up" of the Yamaska and St. Francis for two or more successive springs. The sources of these rivers are very much south of those of the St. Lawrence, and consequently every season the break up of their frozen surfaces takes place many days before that of the St. Lawrence. I imagine that the effects of some such unusually heavy and premature "breaks up" anticipated the ordinary working of the St. Lawrence and created the nucleus of what is now the outer St. Francis Bank; that this was added to subsequently by the St. Lawrence and served as it were as a groin, and caused the waters of the south channels of the St. Lawrence

to glance off into the north channel. Those waters having taken that direction, their operation was to increase the bank, which bank, with the portions called the March Islands, etc., now form a barrier to, and throw the waters of the Yamaska and St. Francis down the lake, parallel with the shore. From my own observation and the best information I have been able to collect, I do not find that these lesser rivers are in the present day able to carry the debris, etc., out into the lake for any distance,—on the contrary, all the trees, etc., which are annually brought down by them are lodged parallel with the south shore and at no great distance from it; that the operations of these rivers do not extend far out into the lake is, to my mind, also clear from the fact of the direct south channel continuing for thirty years—to which period the experience of my informants extends—without the slightest evidence of having shallowed or silted up in any way, notwithstanding the disadvantage it labors under of being dammed across at the up-stream end, and its current therefore acting through it as a scour, so far from being any evidence of this channel having shallowed, it continues precisely, as to depth, direction, width, etc., as laid down in your admirable chart taken in 1830, I believe, except that, at the upper end of it, the current of the St. Lawrence has since that period evidently acted on the bank, by eating away the head of it and forcing a deep-water channel *again* down in the straight line for several hundred yards. This being the case, we may be fairly said to be *acting with* Dame Nature in cutting through the impediment which was, as I conceive, temporarily thrown across the head of the direct channel.

In many parts of this Province, especially as connected with the waters of it, are indications of there having been, at no very distant day, forces in operation which do not now exist, or if they do in a very limited degree—enormous valleys and ravines worked out where there is not a particle of water now to effect it, the heights and beds of rivers totally changed, etc.

Near the commencement of this direct channel we have pretty much stopped a large crooked one of several hundred feet in length, which wound to the southward, by the deposit of our excavation; its original depth of from fifteen to twenty feet we have in great part reduced to seven or eight.

The winter will be disposed of in sundry alterations in the details of our vessels and in constructing some groins, etc. On the break-up, I will most carefully sound the channel, and I am sanguine in expecting to find it deepened by the undercutting of the current. I will acquaint you fully with the result of the examination, and will take the liberty of keeping you apprised, from time to time, of our progress and prospects.

I had intended writing to Capt. Beaufort, to express my sense of his kindness, and to give him a general statement much like the foregoing, but the "yarn" is so much longer than I intended to have spun on commencing, and our parliament having assembled, at which I will be very much occupied, I came to the conclusion of sending him a copy of this, in which I trust you will see no objection. Portions of it, no doubt, will be considered irrelevant; but I could not well curtail it without writing it afresh.

Yours, with much esteem,
Very truly and obliged.

(Signed) H. H. KILLALY.

Captain Becher to Mr. Killaly.

[COPY.]

ADMIRALTY, 1st March, 1845.

SIR,

In consequence of Capt. Beaufort's being prevented by a cold from attending to the immediate duties of his office, I am requested by him to express his thanks to you for your letter of the 21st January and its enclosure, relating to the very interesting experiment in which you are engaged, of forming a ship canal through Lake St. Peter. Of the method which you have so wisely adopted he has expressed his full approval, and it is with pleasure that I have to add to this letter the copy of one to him from Mr. Rendel, the Engineer, expressing his full concurrence in the soundness of the plan you are pursuing. You inform him of your intention of communicating to him from time to time the progress and result of your operations, and I am to assure you that he will look forward to your communications with much interest. And wishing you heartily that every suc-

cess may attend your operations in a scheme which has been planned with so much wisdom, and carried on with so much skill.

I am, sir, your obd't. servant,

A. B. BECHER,
Commander, R. N.

To Hon. H. H. Killaly, &c., &c., &c.

Mr. Rendel to Captain Beaufort.

[COPY.]

16th February, 1845.

MY DEAR SIR,—

I have read the papers, (which I return,) with much interest. I have no doubt whatever that the completion of the groins and turn waters, now in course of construction, will not only have the effect of permanently maintaining the new or rather restoring the old channel, but will also materially aid the process of deepening, particularly in the winter season.

You may at all times command any information I possess in matters of this kind, so pray use me without any scruple.

I am, &c., &c.,

JAS. M. RENDEL.

To Captain Beaufort, R.N.

Captain Bayfield to Mr. Killaly.

[COPY.]

DORSET PLACE SQUARE,
London, 3rd March, 1845.

DEAR SIR,

I have not time to do more, this mail, than offer you my thanks for your note of the 21st January, and the very interesting documents that accompanied it. I will write more at length if I can find time, next mail; but if I should not, you will nevertheless, I trust, not doubt the interest which I feel in the success of the work which you are conducting with so much prudence, and yet with such skill and energy.

The facts you have stated to me, and which, together with the accompanying plans and sections, prove the success of the experi-

ment thus far, were rendered doubly interesting to me, because I had, on the first January, been called upon by the Admiralty to *report fully* upon the subject of deepening Lake St. Peter, in consequence of a communication from Capt. Boxer to their Lordships, in which he decried the work in unmeasured terms.

My opinion of the work, its utility and its practicability, the direction in which the attempt should be made, the preference of the new and straight over the old and crooked channel, and lastly, respecting the mode in which the work was carrying on—were all directly opposed to his, and therefore I was much pleased to find myself borne out by your most gratifying account of the result of the operations of the first season.

I shall be up, (God willing,) to Quebec and Montreal in the *Gulnare* next July or August, to measure the meridian distance more accurately, and I am ordered to report to the Admiralty on the information I can obtain, and shall of course have the pleasure of putting myself in communication with you.

Captain Beaufort has written to you, he tells me.

Excuse haste, and believe me,

Dear Sir,

With much esteem,

Very truly yours,

(Signed,)

HENRY W. BAYFIELD.

The Honorable H. H. Killaly,
&c., &c., &c.

Lake St. Peter.

The following is the reply of His Excellency the Governor-General to the address of the Corporation of Montreal, on the subject of the deepening of Lake St. Peter :—

MR. MAYOR AND GENTLEMEN,

It gives me great satisfaction to receive your valuable and interesting address.

I entirely concur with you in estimating the natural advan-

tages of the great route of internal navigation by the River St. Lawrence; and improved as this has been by the magnificent canals now opened, I cannot doubt but that at a very early period, and under a free and liberal system of Navigation Laws, the superiority of this route over all others—communicating from the sea to the interior of North America—will be universally and practically admitted.

I do not hesitate to express my opinion, that it would not be worthy of a community which has done so much to make the great river of Canada available for navigation, to permit itself to be stayed in its progress by the few difficulties remaining to be overcome before that navigation is perfect—or to allow heavy burthens on trade to continue, when these can be obviated by further outlay, the amount of which, under its most unfavourable aspect, must be inconsiderable as compared with its certain advantages.

Entertaining these opinions, I can the more freely say that you should not be discouraged by the temporary fiscal difficulties which prevent present exertion in the way of public improvement. The depression attending the present extraordinary crisis has been felt heavily in Canada, but not so as compared with the condition of most other countries, while the profound internal tranquillity enjoyed in the Province is having its effect in restoring public credit, and in opening a prospect for the future, which seems to me fair and bright, beyond all former precedent.

I assure you that on the important subject of your address, as well as on all others aiming at the improvement of the country and the restoration and advance of its commercial prosperity, you may rely upon my constant and zealous co-operation.

The following are extracts from the reports of the Board of Works, reports of Parliamentary debates, reports of Commissioners of Inquiry, &c., made during the progress of the work :—

Extract from the Report of the Board of Works.

MONTREAL, December, 1844.

LAKE ST. PETER.

NOTE.—From references in this report, it appears to have been made by Mr. Killaly.

The progress made during the last season towards the effecting of a direct channel through the lake, with an increased depth of water, has been highly satisfactory, and far greater than was expected. The operations of next year, I feel confident, will set at rest the vexed question as to the possibility of effecting this improvement. Being fully aware of the doubts which were entertained respecting it, and looking upon it to be one of those works, the success of which can be satisfactorily determined only by experiment, I took the precaution, long before the work was commenced, of sending a full statement of my views upon the subject, formed after having given it the deepest consideration in my power, to Captain Bayfield, whose science and intimate knowledge of the lake, with its shoals, channels, currents, &c., justly entitle his opinion to be received with the greatest confidence and respect. I am happy to have it in my power to state, that that officer, duly impressed with the great magnitude, importance and difficulty of the work, and without advancing any opinion for or against the practicability of the undertaking further than "that there is quite sufficient ground of hope to justify the interesting experiment," fully agrees with me as to the course that should be taken. He was pleased to say, "I agree so nearly with the views which you have communicated to me in your letter, that there remains little more to do than to express my concurrence therein." I was also desirous of obtaining the opinions of Captain Douglas, of the Unicorn, which are thus recorded by himself:—"I was with the Gulnare and under the command of Captain Bayfield, R. N., when the survey of the lake was in progress and subsequently in command of a steamer (the Canada) for nine years, and was always of opinion that the present contemplated cut, (the direct one), was the only one that would give a satisfactory result, and I have now no hesitation in recording my unchanged sentiments on that subject." The interest taken by Captain Bayfield in the

undertaking, led him to communicate with Captain Beaufort, the Government hydrographer, on the subject, by which the benefit of that gentleman's opinion has also been obtained. Captain Beaufort states that while reading Captain Bayfield's letter, "a civil engineer of considerable eminence, J. M. Rendel, Esq.," entered, and that they discussed the affair "with all the earnestness due to an operation so generous and praiseworthy in the conception, and so big with future advantages in its issue,"—the result of their deliberation he states to be, that the straight channel should be adopted, the shoal at the head of it to be dredged and the channel generally deepened by the use of rakes, and that by means of "groins," formed of piles, interlaced with large brush, with the excavated stuff deposited around them, the waters of the several "alien channels" should be turned into the direct course as much as possible. Among other practical and pertinent observations, Captain Beaufort states that the "rake has been tried with very happy effect" as well in the forming as in the successful preservation of channels.

In proportion as I had to contend with preconceived ideas and mis-statements was I gratified at finding my opinion supported by such high authority as the foregoing, and as it is necessary that the plan of operations adopted should be fully stated, I take the liberty of here giving two or three extracts from a communication I lately had the honor to make to Captain Bayfield on the subject, which explain at large the principles on which the selection of the channel and the course of proceedings were governed.

"For my part I was perfectly satisfied, after much thought, that whatever is to be accomplished must be in the straight channel, and that the obtaining of a moderately increased depth of water and of a direct course instead of the present very crooked one, were advantages certain to be derived from, and sufficient to justify the experiment. I have not been so presumptuous as to predict to what an extent an increase of depth can be obtained, and I have taken good care that the outfit, (*which constitutes three-fourths of the expenditure up to the present time.*) is such as to be applicable to the improvement of the several portions of the upper navigation and of the harbours on the lakes, which so much require it. From the very nature and magnitude of the work, practical men would be cautious and slow in coming to a

"decision, but in such cases where, as I conceive, experiment in conjunction with theory and science must be resorted to before any final and satisfactory conclusion can be arrived at, were they deterred from having recourse to it by unfavorable predictions, always plentiful on such occasions, and as often emanating from very ill-informed sources, many of our noblest existing works would never have had being."

Again—"I have ever been an advocate for following and acting in concert with *"Dame Nature,"* especially in water operations, it was not therefore without a great deal of consideration that I took the direct south channel. I need scarcely repeat to you the reasons for so doing; the power of diverting such a mass of water down it, its being capable of being made perfectly straight, the risk of collision being thereby much lessened, the only obstructions in it being at the head where we can bring the force of the St. Lawrence *directly* to bear on them—the great facility of our working in it, compared with the present circuitous channel used by the trade, in which our vessels, leading chains, mooring cables, buoys, anchors, attendant lighters and tenders would be constantly in the way of and getting foul of the vessels passing at all hours."

"The results of our operations this year are so satisfactory, and so far beyond what I had calculated on, that I do not hesitate to express to you my conviction that success is certain and will be speedy. I send herewith a section shewing the state of the work at the commencement and termination of the past season. It is formed from soundings taken most carefully by Captain Vaughan, our Superintendent of the work, in conjunction with Captain Rayside, the Harbour Master and chief officer of the Trinity Board of this city. Of the experience and capability of both these gentlemen, you are, I believe, fully aware. The soundings were taken on the 19th of the present month, on a calm day, and with a pole marked into feet and inches.

"Our machinery, at the commencement of the season, was deficient in several respects, so much so, that from the many unavoidable interruptions, I consider we in reality worked not much more than half the season; yet the results, I am sure, you will consider far greater than you could have calculated upon.

"By taking the most moderate measurement of the quantity of
 "stuff which has disappeared, and comparing it with that which
 "the united loads of the number of barges discharged daily dur-
 "ing the season, (and of which a regular log was kept,) would
 "give, it is certain that the quantity carried off by the current is
 "equal at least to that absolutely lifted. The current has obvi-
 "ously and seriously been increased; on commencing, a man could
 "scull across the channel easily with one hand, it now requires
 "stiff pulling to get across it without drifting much. The origi-
 "nal buoys we put down to mark our local, and which floated
 "well up, are now kept under water from the strength of the
 "current. Not only had the dams and groins, suggested in Cap-
 "tain Beaufort's letter, and referred to in that I had the pleasure
 "of receiving previously from you, been decided upon, but the
 "mode of their construction. I had directed that the piles should
 "be cut away at low water or a foot under it, so that the river on
 "the "break up" would float the ice over them, and I had
 "instructed Captain Vaughan to have "wattled in" among these
 "piles, trees with their branches. The stuff excavated has also
 "been deposited according to Captain Beaufort's idea, namely,
 "in stopping up the mouths of the alien channels; the result of
 "which the greatly increased current in the direct channel fully
 "shows, and to the effects of a rake, which I have had briskly at
 "work, I attribute very much the disappearance of so great a
 "mass of stuff beyond that actually taken up. So far as I can
 "form an opinion, the nature of the stuff is of a fortunate consis-
 "tency, sufficiently tenacious not to threaten silting up, and yet
 "capable of being raked up and carried off by the current.

"You are aware that the ice on the great surface of the lake
 "becomes grounded on the shoals. I expect much to be effected
 "by this operation also, as the passage of a large portion of the
 "waters of this vast river, instead of being diverted as heretofore,
 "into several small and crooked channels, will take place down
 "the new straight one, and I calculate therefore that considerable
 "undercutting will take place; this I have observed invariably
 "occurs in the second class rivers of this Province wherever the
 "bottom is not rock. The main groin to throw the united
 "volume directly down the new channel we cannot complete until
 "the channel is available to the trade.

"When the channel is created, my idea is to construct at each end an isolated, substantial pier, with a lighthouse on each; these, together with the straightness of its course, will enable it to be used at all times, and I have no doubt the constant passage of the steam vessels will much aid the stream in the keeping clear and deepening of the channel.

"Our outfit consists of two steam dredges, with two engines and one chain of buckets to each, working in the centre of the boats, also two steam tug vessels; one of these is employed constantly at the towing of the scows, in which the other also assists, but, when not so employed, she works the rake. I am inclined to believe that we may be compelled to get a third, for if the dredges work as well next season as they did towards the conclusion of the past one, the services of the two tug-boats would be required at the scows. We have but one rake, but I will have another made this winter, there being many days during the season when, from the roughness of the lake, the dredges cannot work, but the rakes could be used to great advantage; the discharging scows, fuel and attendant lighters compose the remainder of our squadron.

"That this channel when once opened throughout and with the greatly increased volume of water passing through it, will keep open, I have no doubt. The trees and other *debris* now annually brought down by the Yamaska and St. Francis rivers are not carried out far, comparatively, into the lake, but are deposited parallel with the south shore, and that the effects of these rivers will not be to obstruct or silt up the channel, I am of opinion is evident from the fact that they have not for the last thirty years, to which period my information extends, affected it in any sensible manner, although it has for that time labored under the disadvantage of being stopped at the upstream end, and had therefore no "scour" through it."

I trust I will be excused for the length of these extracts from my communication to Captain Bayfield, but public attention being much drawn to this work, I felt it to be incumbent on me fully to explain all the details connected with it; this I could not do more simply than in the foregoing.

The whole amount of the appropriation for this work is £65,000, the sum expended £32,776, 9s 3d, of which £27,291 has been the

cost of the outfit of every description, applicable to any other work, leaving but £5,534 actually chargeable to this work. This balance will be sufficient to provide fuel, meet repairs, and maintain the full establishment at work for two years more, long before the expiration of which, satisfactory evidence will be afforded of what can be done.

I beg leave to draw attention to the chart of the lake and section of the channel, which will be found in the appendix (letters F and G).

Extract from the PILOT.

Sept. 2nd, 1845.

To His Excellency the Right Hon. Charles Theophilus Baron Metcalfe, etc., etc.:

The Petition of CHARLES L. ARMSTRONG, of the Borough of William Henry, Mariner, humbly sheweth;—

That your Petitioner has been since the year 1813 engaged in the navigation between Quebec and Montreal, respectively.

That your Petitioner is now commander of a steamboat running between the said cities, of the largest class.

That your Petitioner, being often called upon by private individuals to express his opinion upon the works now going on in Lake St. Peter, conceives it his duty to lay before your Excellency the following observations:—

That the chart of Lake St. Peter, as printed in the Report of the Chairman of the Board of Works, lately submitted to the Legislature, does not convey a correct description of the present channel. That the present channel is neither "very crooked" nor "very circuitous," that it is sufficiently straight for the purpose of navigation, ships having come up in tow of steamers several times during the night when drawing as much water as there was in the lake.

That with the exception of a bar of one hundred and fifty feet there is, at the lowest water in Lake St. Peter in the present chan-

nel as far as the second light vessel placed nearly opposite Rivière du Loup, from 18 to 20 feet. That the said bar could be dredged in a few days.

That after the said "straight" channel is completed as far as Rivière du Loup, it will cost as much to continue it to deep water as it will to deepen the present channel. That all the dredging, piling, etc., attending the new channel through the *batture* of St. Francis to opposite the light vessel at Rivière du Loup, will be lost, as the depth of water, and the distance from that point downwards, are the same in either channel, and consequently would be attended with the same expense in deepening.

That had the same quantity of work been done in the old channel below Rivière du Loup as reported to have been done in the new one, it would have been partially available next season; whereas the "straight" channel will take a much longer time in the completion of it, and be subject to all the risks of being filled up by sand.

That the distance to be saved by making a "straight" channel, in preference to deepening the present channel, is not more than one mile, a distance too trifling to be, in the opinion of your Petitioner, a satisfactory reason for the expenditure of several thousand pounds over and above that which is necessary.

That the soundings, as given by the Board of Works, are incorrect, more particularly where part of the proposed channel is compared to the "traverse" in the present channel. That with reference to the opinion given by Captain Douglas of the steamer *Unicorn*, or quoted in the report of the Chairman of the Board of Works, your Petitioner has to state that Captain Douglas has acknowledged in a most straightforward and satisfactory manner in November last, that he was mistaken in giving the opinion quoted in the above report.

That the experiments made under Mr. Atherton, Civil Engineer, employed by the Board of Works, show that more work could be done in a given time in the present channel than in the one now attempting to be made, and with less injury to the machinery.

That the damming up of the different navigable channels between the Islands of Madame, Ours, etc., may cause the inundation of valuable farms around the Lake St. Peter. Your Petitioner would remark that a strong current in a narrow channel fre-

quently causes a jam or bank of ice, and in proof of this he would mention the Chaudiere, Richelieu, and Cap-a-la-Roche; a jam in the latter place being felt at Sorel in 24 hours.

That the dams erected, or to be erected, at the mouth of the St. Francis and Yamaska rivers, will cause these rivers to be filled up, in a very short time, by making shoals opposite the said rivers. Your Petitioner is supported in these views by Mr. Killaly, who states in his report, already mentioned, that "the trees, and other debris now annually brought down by the Yamaska and the St. Francis Rivers, are not carried out far, comparatively, in the lake, but are deposited parallel with the south shore.

Wherefore your Petitioner prays that an inquiry may be instituted by your Excellency, and that your Petitioner may be examined with such others as your Petitioner will summon, to prove the allegations above made to your Excellency.

And your Petitioner, as in duty bound, will ever pray.

C. L. ARMSTRONG.

Sorel, 5th April, 1845.

About a month after the petition was sent to the Provincial Secretary's office its receipt was acknowledged. The following letter was afterwards addressed to Mr. Daly, dated :

MONTREAL, 4th August, 1845.

SIR :

At the request of Captain Charles L. Armstrong, of the Borough of William Henry, I, early in the month of April last, addressed to you a petition of Captain Armstrong's, the receipt of which was, during the month of May, acknowledged by the Assistant Provincial Secretary East, who at the same time stated that the petition had been sent to Hon. Hamilton A. Killaly, for his report thereon.

Not having heard any further respecting his petition, Captain Armstrong is desirous of knowing if any action has been had upon it, and if an opportunity is to be allowed or denied him of establishing the allegations therein made by him.

I have the honor to be,

Sir,

Your most obedient servant,

JAMES ARMSTRONG.

Extract from the MONTREAL GAZETTE.

October 9th, 1845.

We copy the following from the *Transcript*. Our own opinion of the value and probable cost, and period of completion of the new channel is altogether different, but it is desirable that on so important a question all sides should be heard:—

“A great deal has lately been said respecting the works going on in lake St. Peter, and we now purpose to make some observation on them. We learn from Quebec that the Bark “James Campbell” has passed through what is called the “new channel,” drawing as much water as there is in the shallowest part of the present channel. This has been accomplished after twelve months work being spent in making a channel 12 or 13 feet deep, three miles long and sixty feet wide—we say sixty, though we have been informed it is not more than forty. Yet although this has been done, and some thousands of pounds have been spent, it will be a saving of a great many more thousands, if the works now going on be abandoned, and the present natural channel be deepened. A channel less than 1500 feet wide will be useless, and even if it be made of that width, it will not be so useful as the present channel. The matter is now before the commissioners of the Board of Works appointed to inquire into the state etc.; it is therefore unnecessary to make any lengthened remarks upon it. It is, however, proper to notice a communication which has already appeared in the *Pilot*. It is contended by the writer that in the present channel, with the exception of a “bar of one hundred and fifty feet,” there is, at the lowest water in lake St. Peter, as far as the second light vessel, placed nearly opposite Rivière-du-Loup, from 18 to 20 feet.

After twelve months' labour—for the works were begun in May, 1844,—thirteen feet have been attained in the “new channel” of sixty feet wide. At this rate, it will be the labour of more than a half dozen of years to make a new channel of proper width to Rivière-du-Loup, while the present channel could be made navigable to Rivière-du-Loup for ships drawing eighteen feet of water by the labor of a few days. We will suppose that two companies were formed in May, 1844—one for deepening the present channel, another for the making of a new one; the first would, in a week,

have had a channel to Rivière-du-Loup on both sides of which the water is very deep. The second, after working till October, 1845, would have had a channel of 13 feet of water and sixty feet wide, and shallow water on both sides of it. It is also to be borne in mind that when the new channel is made as far as Rivière du-Loup, it will cost as much to continue it to deep water as to deepen the present channel; and that it cannot, unless made of an extraordinary width, be so useful as the present channel. There are other objections to the works now going on, which may hereafter prove of serious importance, if the works are persisted in, as at present."

The following narrative of the master of the *James Campbell*, appeared in the *Herald* of yesterday :—

"I left Montreal at 7 o'clock on Thursday morning, under sail, my ship drawing 12 feet 5 inches water. On passing Flat Island we rubbed the ground hard—a circumstance which will satisfy all persons acquainted with the navigation of the river that, without lightening the vessel, we could not have succeeded in passing the old channel, there being always some four inches less depth of water in Lake St. Peter than upon Flat Island. At 1 o'clock p.m. we reached the head of the lake and the entrance to the new channel. Captain Vaughan, however, was not prepared for us, and we, accordingly, lay-to, until he had lifted the anchors of the dredging vessels out of the channel and then opened it for our passage. It was close upon sundown before this was effected and at this time Captain Vaughan returned to where we lay, with the small steamer *St. Peter*, to take us in tow. As I was very anxious to proceed, I, notwithstanding the lateness of the hour, urged upon Captain Vaughan that we should endeavour to get through the channel that night, and in justice to him, I must say that he only attempted it at my earnest desire and against his own better judgment. On entering the channel we found the current, (running about two miles an hour,) stronger than we had expected, and, partly in consequence, in turning the upper buoy, the ship sheered to the south and grounded forward upon the bank. It was then too late to attempt to proceed until day light in the morning, when, having without difficulty got off the ship, we passed through the entire channel without grounding or meeting with any accident whatever. The channel is perfectly straight,

(no trifling advantage,) is, I think, about two miles in length, average about 120 feet in breadth, and, where the dredging has been carried on, is about 14 feet deep. Below, where the dredges have not yet been worked, we found 12 feet 9 inches of water, gradually deepening as we proceeded down the river.

I here tried the bottom and drove a pole four feet into a soft adhesive clay, very easily removed, and which, from its consistency, appears a guarantee that, when once made, the channel will not be apt to be filled up by the action of the stream, as would be the case were the bottom of sand.

I cannot conclude this short statement of facts, without thanking Captain Vaughan for his kindness and attention, congratulating him on the successful result of his labors in the public service, and the merchants and ship masters, upon the great facilities which this channel, when completed, will give to the trade of your rising port."

EXTRACT FROM THE REPORT OF THE CHAIRMAN OF THE BOARD OF WORKS, 1846.

LAKE ST. PETER.

NOTE.—This Report appears to have been made by Mr. Killaly.

The operations towards the obtaining of a straight and deep channel throughout the Lake have progressed most satisfactorily during the present year. The general repairs and alterations in many respects which the machinery has undergone rendered it infinitely more effective, so that in fact it was capable of doing nearly twice the work it had previously done.

In addition to the dredging, a vessel was chartered for a month for the purpose of working a heavy rake, which, during the short time it was in use, accomplished a great deal towards the levelling of the ridges which were left after the dredges. The channel is now buoyed out in a most effective manner, and the current has taken the direction of it.

The first object aimed at is to open from end to end a channel of 150 feet in width, with not less than 14 feet in the lowest water,

which will be fully 3 feet more than the depth afforded by the old channel. A favorable time during last winter was selected, when the lake was low and the surface smoothly frozen over, to have the channel longitudinally measured off into lengths of 200 feet, and at each division, at right angles across the channel, holes were cut and soundings accurately taken at every twenty-five feet by Mr. Keefer, accompanied by the Superintendent of the work. From the result of these measurements, an accurate chart has been made, which shews very satisfactorily the precise state of the work. The relative progress made is as follows:—

In the first three and a half miles there have been removed 406,111 cubic yards. In two or three places, for a short distance, the breadth is little over 100 feet. To open the channel to the breadth of 150 feet, and continue it uniformly of that breadth throughout to the eastern end of the flats, and having not less than 14 feet at lowest water, requires the removal of but 303,525 cubic yards. Besides the above quantity, 406,111 yards, already removed in the line of this breadth, a large quantity has been taken up in the first one and a half miles at the western end, outside of the breadth stated, so that I see no reason whatever to doubt but that if our machinery works as well this season as it did last, a perfectly straight channel of 150 feet in width, with 14 feet in depth, will be had at the close of the year. This being effected, the channel so obtained will be available to vessels towed, or sailing with a leading wind. It has also been ascertained, by accurate measurement, that to add another 150 feet to the width of the channel would require the removal of but 433,342 cubic yards, being not much over half of what was required to be moved in the first breadth. This is owing to the quantity of excavation removed during the first season on the south side of the channel, as well as to some natural deep holes or channels which will fall into the breadth of 300 feet.

The sum of £61,403 2s. 5d. has been expended, of which the large proportion of £38,000 was upon the dredge, tug vessels, scows, lighters and other machinery, all of which are now in the most effective order, and prepared for work. Assuming the outfit to be suited to and required for the removal of various shoals in other parts of the navigation and for the improvement of several of the Harbors, (which is the case,) the sum of but £23,403 2s. 5d.

would be chargeable to the work already effected on Lake St. Peter; the cost of this season's operations, including fuel, wages, &c., and allowing £1,000 for contingencies, will be but £8,500, so that if, as I expect, a channel of 150 feet in width and 14 feet in depth at lowest water is obtained by the end of this season, it will have been obtained at a cost of £31,903 2s. 5d. The amount of stuff to be removed to obtain an additional breadth of 150 feet as before stated, is but 433,342 cubic yards, little more than half of what will have been taken out by the close of the season, so that it seems to me safe to calculate on its being effected at an additional cost of two years more work, estimated at £17,000 or say £20,000.

The aggregate expense therefore of effecting a channel of three hundred feet in width and fourteen in depth at lowest water, from the deep water at the west of St. Francis Bank to the deep water at the east of the flats, a distance of upwards of eight miles, will be £51,904. 2s. 5d.

When a channel of three hundred feet in breadth and fourteen feet in depth has been so obtained, I would then recommend the suspension of the operation of dredging, and to work heavy rakes, by means of the two tug boats, for a season, having no doubt but that important advantages would be obtained thereby in additional depth and otherwise.

To enable some opinion to be formed as to the advantages to be had therefrom, I take the liberty of furnishing a copy of a statement carefully prepared by W. Hall, Esq., Collector of Customs for this port, who has taken a good deal of pains to inform himself upon the subject, to which he has given much consideration for many years.

Question.—A vessel of 370 or 400 tons, drawing 11 feet 9 inches water, what number of tons will it require to sink her down one foot?"

Answer.—In answer to the above, we consider that it would require between 60 and 70 tons weight to sink the vessel another foot.

Question.—In reference to the foregoing question, supposing it would take between 60 and 70 tons weight, how many tons of measurement goods, taking the average of cargoes coming to the Port of Montreal, to answer the same purpose?

"*Answer.*—We beg to state that it is impossible to answer this question accurately, but we would suppose it would take double the quantity of measurement, goods from London, *i.e.*, 80 feet to the ton, and from Liverpool one and a half, *i.e.*, 60 feet to the ton to have a similar effect."

(Signed,)

W. T. CHALMERS,
Master of "Pearl."

"

J. DUFFILL,
Master of "Lady Seaton."

"

J. MORTON,
Master of "Margaret."

"

A. S. SMITH,
Master of "Save-guard."

"Calculations made on the preceding statement, showing the advantage and gain to the trade of Montreal from what has now been done in Lake St. Peter by obtaining one foot more water in the proposed new channel than there is in the old one, viz:—

"Upwards, lighterage from Quebec to 60 tons	
"weight, equal to 100 tons measurement at 10s. per	
"ton.....	£50 0 0
"60 tons weight, equal to 670 barrels of flour,	
"freight to Quebec at 7½d. each, is.....	20 18 9
	<hr/>
	£70 18 9

"Out of 200 vessels coming to Montreal, say 80	
"between 300 and 400 tons which have to lighten,	
"will save by drawing one foot more water, £70	
"each as above, will be.....	£5,600 0 0
"Say 20 vessels of a smaller class which have also	
"to lighten, by drawing one foot more water, will	
"save say one half of the above, £35 each, which will	
"be.....	700 0 0
	<hr/>

"Saving to the trade on lighterage up and down.... £6,300 0 0

Customs, Montreal, 17th Oct., 1845.

*Second Report of the Commissioners of Enquiry into the Management
of the Board of Works.*

22nd May, 1846.

LAKE ST. PETER IMPROVEMENTS.

*To His Excellency the Right Honourable Charles Murray, Earl
Cathcart of Cathcart, in the County of Renfrew, Governor-
General of British North America.*

The Commissioners of Enquiry into the state and management of the Board of Works beg leave most respectfully to report that the Commissioners had scarcely entered upon their duties when their attention was directed to the works in progress on Lake St. Peter for the improvement of the navigation, by persons proffering their testimony to prove that the straight line adopted by the Board of Works for the new channel would never answer the purpose intended; that it would require fifteen or twenty years for its completion, at a great outlay of money, and that it would fill up nearly as fast as it was taken out. From these objections, and others not necessary here to recapitulate, the parties making them gave the preference to the improvement of the old channel over the new line adopted by the Board. The subject, too, had attracted general attention, and various discussions had, from time to time, taken place in the public prints on the merits of the respective channels.

Considering it to be a matter of great importance, and falling within the scope of their commission, they deemed it their duty to enter into a careful examination of all the different opinions, letters and other documents connected with the works in question that were submitted to them by the Board of Works.

In the month of October last, the Commissioners requested the Chairman of the Board of Works to cause an accurate plan and sections of the newly-dredged channel through the upper bank, or shoal, to be taken after the work should be suspended for the season, with a view to ascertain whether the spring flood would have any effect in filling up the channel.

This was correctly done by Mr. Keefer, the engineer of the Board, after the formation of the ice upon the lake, and the sections then made accompany the present report.

On the 24th day of April last, (the high water of the spring had subsided), the Commissioners proceeded to the lake for the purpose of ascertaining the effects of the spring flood upon the new cut, and of examining the operations going on and the progress of the work. In this visit they were accompanied by a deputation from a committee of the Board of Trade of Montreal.

The first thing they examined was the cut through the upper bank at the entrance of the Lake, upwards of two miles in length, and from the soundings which they took across the different sections through the whole length of the excavation, they found that no perceptible filling up had taken place, but that the cut remained in the same state as the dredges had left it the previous fall, as appears from the accompanying sections.

The Commissioners next proceeded to examine the operation of the dredging boats, and found them working in the most satisfactory manner, the two dredges, according to a close calculation, removing on an average about 2321 cubic yards per day. The bank is composed of a blue clay, sufficiently tenacious to remove all apprehensions as to the channel having any tendency to fill up. The upper bank is of the same material, except as to the upper surface, in which there is a slight mixture of river sand, but the composition possesses equal tenacity with the other.

The dredges have commenced operations at the upper end of the shoal, nearly opposite to the Upper Light in the old channel, distant about two miles to the north. The distance from this point to the deep water at the lower end is about six miles, and requires to be dredged—the first four miles requiring the removal of about two and a half feet on an average to give a depth of fourteen feet at low water, as proposed by the Board of Works; and the last two miles requiring one-fourth to give the same depth. To make the channel, therefore, 150 feet wide, as proposed for this year, would require the removal of 352,000 cubic yards, which, at the rate of 2321 yards per day, would take about 152 working days to complete.

The Commissioners also examined the old channel now in use, from the deep water at the lower end of the shoal to the light at the upper end, and found by sounding that there is scarcely any difference in depth on a parallel line across the Lake between the present circuitous channel and the new and direct line.

The Commissioners, after mature consideration of the information derived from the various sources, have come to the following conclusions :—

That the new and straight line adopted by the Board of Works, and now in progress, is preferable to the old and circuitous channel, and that the Board is fully borne out in the adoption of this line by the valuable opinion of Captain Bayfield, and other scientific men in England.

The Commissioners have no doubt that the first cost of improving the old channel would have been less than that of the new, as the length of the cut necessary for the one is two miles and a half less than that for the other. But that difference of cost will, in the opinion of the Commissioners, be far more than counterbalanced by the great advantages of the straight line over the circuitous channel, both from greater facility of navigation, and in the keeping of the channel clear hereafter.

They are furthermore of opinion that the difficulty of obtaining a correct estimate of the total expense is now in great measure, if not entirely, removed, by the experience in the progress of the work for the last two years, from which the cost of dredging now in successful operation can be calculated to something like a certainty.

The plans and sections of the work which were made during the last winter, exhibit the amount of work that had been done to the close of 1845, and what still remained to be done, from the opening of the season of 1846, in order to complete the channel to the width of 150 feet, with a depth of 14 feet at low water. The calculations founded upon them have been verified by the actual admeasurements above referred to, the difference in the two resulting estimates of quantity arising from the Commissioners having made a more ample allowance than the Engineer of the Board.

From the same sections, calculations of the time and expense necessary to extend the channel to 300 feet wide by 14 feet deep have also been made, and form the basis of the last report of the Chairman of the Board of Works on this subject.

From these it appears that the sum of £30,000, over the present appropriation, will be required to obtain this desirable end,—to be spread over a period embracing three seasons—of which only

£8,000 will be required during the season now commenced, to make a complete channel of 150 feet in width, and render it at once available for vessels which, from their draft of water, are prevented from using the old route.

The trade would thus be in possession of two channels, of which the one might be made to serve for vessels for whose draft of water it is suitable, and the other to serve for vessels of a larger draft. The risk of collision would thus be very much reduced, and the arrangements could easily be carried into effect by a By-law of the Trinity Board. The Commissioners are also confidently informed, that the operations necessary for extending the channel to 300 feet wide will not in the least incommode the passage of vessels through the new cut, while such operations are in progress.

The gross amount expended on the Lake improvements by the Board of Works, up to the close of the work last season, was £59,994 1s., but of this there was an amount of £37,937 9s. 5d, laid out upon steamers, dredging boats, scows, machinery, and other outfit.

This apparatus, although of course not now equal to that value in consequence of wear and tear, will be available to the province for other improvements in the deepening of the shoals, &c., on the various lakes, and, if the original cost be deducted from the gross amount expended, the actual expense of the excavation of the new channel when made to 300 feet in width will not greatly exceed the original appropriation.

Before concluding, the Commissioners think it their duty to advert to an objection which has been made against the new channel from the danger to be apprehended of rafts getting into it and impeding the navigation through it. This objection they consider as being not founded on considerations which require much notice. They cannot see that in a Lake of such width any more danger is to be apprehended from collisions from this cause than now exists. Rafts do not generally draw more than three feet and a half of water, and consequently can float over the whole surface of the lake without difficulty.

The Commissioners, in conclusion, beg to state that they have deemed it to be their duty to make a special Report to Your Excellency on this work, in consequence of the conflicting opin-

ions which have been set forth regarding it, and the conviction in their minds that any delay in the execution of the work would effect most injuriously the commercial and agricultural interests of the country. They feel convinced that from none of the public works now in progress will greater advantages be obtained to the country in proportion to the cost, and that its speedy completion will tend greatly to diminish the high rates of tonnage, and the still greater expense incurred by lighterage,—thus lessening the heavy cost to which vessels are now subjected in clearing from the Port of Montreal, a result desirable at any time, but more especially at this crisis of our commercial relations when the protective duties on Colonial produce are likely to be either entirely withdrawn or greatly reduced.

The Commissioners consider it their duty to mention, in connection with the above work, that there are two narrow shoals in the River at Lavaltrie, which should be deepened during the present season to the same depth as the new channel, since without that, the important improvements of the Lake will not be available.

The whole, nevertheless, respectfully submitted.

F. A. QUESNEL,

M. J. HAYS,

T. REDPATH.

Montreal, 14th May, 1846.

*GENERAL STATEMENT of Expenditure upon Lake St. Peter, from
December, 1841, to December, 1845.*

OUTFIT.	£	s.	d.	£	s.	d.
Millar, Edmonstone & Allan—Steamers, &c.	2,802	0	0			
David Vaughan, “	3,737	7	10			
J. & J. Nesbitt, “	4,146	18	0			
Tobin & Murison, “	25,00	0	0			
St. Mary's Foundry—Machinery.....	9,665	13	1			
Ward, Brush & Co., “	4,884	3	4			
William Kerr, “	2,473	9	5			
John Armstrong, “	1,233	2	5			
William Parker, “ and Buoy.	1,200	14	1			
Sundries for Outfit in 1842-3-4-5	3,049	15	8			
Carter & Cowan—Ship Chandlery.....	2,070	11	11			
H. E. Scott—Materials	173	13	8			
Total for Steamers, Dredges & other Outfit.				37,937	9	5
Survey				650	2	7
Plans				56	0	9
Establishment.....				10,723	8	11
Postage				69	12	7
Freight and Towage				969	19	6
Advertising				16	6	3
Law Expenses.....				21	5	0
Firewood.....				2,195	14	8
Travelling Expenses				165	10	6
Sundry Accounts				2,259	19	0
Examining Accounts				57	7	6
Insurance				161	2	0
Labor.....				2,246	13	2
Rent of Ship-yard.....				156	5	0
Coals				2,405	18	10
				60,092	15	8
Deduct for materials sold.....				98	14	8
Total expenditure.....				59,994	1	0

With Second Report of the Commissioners of Enquiry into the management of the Board of Works, dated Montreal, 14th May, 1846.

Extract from Parliamentary Debates, reported by the "Mirror of Parliament of Lower Canada."

15th May, 1846.

Mr. ARMSTRONG moved for a committee to inquire into certain surveys said to be made on Lake St. Peter. He said he understood that besides the report of the committee appointed by the Board of Trade to enquire into the works on Lake St. Peter, another report had been presented to the Board of Trade by Capt. Boxer and five other gentlemen, which he understood was to be suppressed.

Mr. Cayley said that he thought that the hon. member had made use of a very uncalled for expression as to the suppression of the report; (Hear, hear.) The report of the Commission of Enquiry would be presented next day to His Excellency, and would, of course, be very shortly afterwards submitted to the House. For anything which might have been done by the Board of Trade, of course, the Commission was not answerable, but he could assert that there was no desire whatever for any concealment on the part of the committee.

Mr. Armstrong was not a little surprised that the hon. Inspector-General should offer any opposition to the motion after the interview he (Mr. A.) lately had with him. He could well understand the hon. member when he said that certain persons went down to survey Lake St. Peter, but that they were invested with no authority by Government, and that he (the Inspector-General) invited Captain Boxer to accompany the Commissioners. But he (Mr. A.) took it that when the hon. Inspector-General took the part he did on that occasion he acted as the Government, and he would put the question, did he (the Inspector-General) not invite Captain Boxer to aid in surveying Lake St. Peter; did not the Board of Trade request one of their body to join in the survey, and did not Captain Armstrong, one of the oldest navigators of our waters, and two other experienced pilots also take part in it. He (Mr. A.) did not exactly expect an official yea or nay, but he thought the hon. Inspector-General could not deny that he was cognizant of the fact; be that as it might, he (Mr. A.) would, in consequence of the unexpected opposition he

had met with, state facts which he would not otherwise have been induced to refer to. Messrs. Hays and Redpath, as commissioners to inquire into the proceedings of the Board of Works, proceeded to examine Lake St. Peter, accompanied by certain gentlemen who, according to the hon. Inspector-General, were volunteers, viz., Captain Boxer, R.N.; Captain Armstrong, of the steamer "Sydenham;" John Young, Esq., a member of the Board of Trade; Messrs. Côté and Hamelin, two most experienced pilots. Now it is currently stated that the report of Messrs. Hayes and Redpath, although diametrically opposed to that of the other gentlemen, has been accepted by the Board of Trade, and the other disallowed. The object of the motion was to procure both these reports, and to examine parties in reference to the work; and he (Mr. A.) believed that no hon. member of that house who valued his independence, would resist an enquiry so obviously called for.

Mr. Cayley said those five gentlemen of the Board of Trade who accompanied the commissioner and Captain Boxer, were not recognized by the Board of Trade, but went upon their own responsibility.

Mr. Moffat said that, as a member of the Board of Trade, he knew nothing of the proceedings referred to, and begged to assure the hon. member for Berthier that any report presented to the Board of Trade could not be suppressed, but must appear on the journals, and could be seen at any time by a member of the Board, and even copied from the book.

Mr. Armstrong knew that the report drawn up by John Young, Esq., Captains Boxer, Armstrong, Côté and Hamelin, was refused, that is, not adopted by the Board of Trade, and that by Messrs. Hayes and Redpath was adopted.

Mr. Moffatt—Whether adopted or not, every report presented was on the journals and could not be suppressed.

Atty-Gen. Smith considered the motion to be premature. The report of the commissioners appointed to examine into the affairs of the Board of Works had been laid before His Excellency that day, and would be communicated to the house either on Monday or Wednesday: then if the statements which were made in that report, with respect to the works on Lake St. Peter, were

not satisfactory, it would be perfectly legitimate for the hon. member for Berthier to move for a committee to examine the subject.

Mr. Armstrong said it would be remembered that during last session he (Mr. A.) objected to and condemned the plan of the Board of Works to shut up the different channels leading from the north and south shores; piles were brought in great quantities, piling had actually commenced, as drawn on the map, but lo and behold, when the absurdity of the work became too notorious, the Board of Works had the effrontery to say that it was never in contemplation to stop up the channel. He (Mr. A.) would predict that after another year's expenditure, the work now going on in Lake St. Peter would also be stopped; but he would have the satisfaction of knowing that he had done his duty, that he had raised his voice against waste. It might be asked why he took such interest in the work in question? It was because he lived in its immediate locality, and was cognizant of all that was going on; and he felt that it was due to his country, his conscience, and that House, to state the facts he had stated; he would repeat that he did not see why the motion he had submitted was opposed; it was to enquire into a large expenditure of money which he (Mr. A.) denounced as useless; yes, he would assert that ten years' work and ten times the money expended would not make the contemplated new channel as good as the old. He (Mr. A.) would declare in conclusion that he had no feeling against the Board of Works except on public grounds; he believed that he had not an enemy on the Board, and he had much respect for many of its members whom he knew, and as regarded his county, there was no reason to complain, but he believed some great error existed about Lake St. Peter.

Motion agreed to.

The following evidence taken by the Select Committee of the House of Assembly in May, 1846, contains various opinions for and against the straight channel. From this investigation it appears the straight channel had been excavated to a depth about equal to the old natural channel with a width of from 100 to 150 feet. The vessel James Campbell passed through it in October 1845.

REPORT.

1st June, 1846.

The select committee, to whom was referred that part of the Report of the Chairman of the Board of Works which refers to Lake St. Peter,—Beg leave to report to your Honorable House :—

That your committee proceeded to examine into the subject submitted for their investigation on the 16th day of May, 1846, and continued their sittings from day to day receiving the evidence of numerous individuals immediately interested in this controversial question or who are qualified to give an opinion in reference to the navigation of the said Lake; your committee also examined a great mass of documentary testimony in relation to the same subject.

Your committee embraced with avidity an offer made by the chairman of the Board of Works to place at their disposal a small steamer usually employed in the Board's operations on lake St. Peter, to convey them down to that place, for a personal inspection thereof: but your committee sincerely regret that any circumstances should have prevented Mr. Killaly from accompanying them to the locality of the disputable ground, your committee experienced every facility in furtherance of their design; and the weather proving propitious, the soundings on the lake were taken with great accuracy and precision, which was accomplished most satisfactorily by passing and repassing entirely through both the old and the new channels, sounding every four minutes; the result of which operation tested the general accuracy of Capt. Bayfield's survey and sounding.

Your committee, assuming that any channel made by dredging the bottom of the lake ought not to be of less dimensions than 150 yards wide, and fourteen feet in depth, at the driest season of the year, have based all their calculations on such capacity.

The accompanying charts of the said old and new channels of the lake are accurately made by your committee, and the soundings thereon are those made by them on the 25th day of May last, and the estimate of the amount of excavation required to complete either channel, is predicated on such soundings.

Excavation required to improve and complete the present ship channel from deep water to deep water,—the little Bank before you reach the first light vessel.

	Feet	Inches.				Cubic Yards.
Average,	2	6	for	81	Yards,	10,150
"	3	2	"	2640	" 1½ Miles.	418,000
"	2	4	"	do	" do	307,950
"	1	9	"	do	" do	231,105
"	"	6	"	1100	" do	27,500
						<hr/> 994,705

Amount of excavation required in the new channel from near the seventh Buoy down to the deep water.

	Feet	Inches.				Cubic Yards.
Average,	2	10	for	1760	Yards, 1 Mile.	249,333
"	2	7	"	do	" do	226,286
"	2	2	"	do	" do	190,882
"	2	0	"	do	" do	176,200
"	1	6	"	do	" do	132,000
"	0	6	"	880	" ½	22,000
						<hr/> 996,701

The dredges now remove 2321 cubic yards per day, (see commissioner's report on page 4.) It will therefore take 418½ working days to complete the present ship channel throughout; and allowing, by a fair computation, that the dredges commence operations in the spring on an average of years on the 10th day of May, and retire from the autumnal operations on the 10th day of November, which makes a period of six months, and allowing on an average of months, that in each month there will be twenty-one working days, we have 126 working days in the year; and, as the chairman of the board of works estimates that the whole establishment on lake St. Peter, including £1000 a year for contingencies, costs £8,500 a year, (see the chairman of the board of work's report for the year 1846, page 13,*) it follows that the entire excavation for completing the present old ship channel throughout may be fully accomplished for the sum of £28,473.

* See page 95 of this pamphlet.

The above estimate of required excavation is taken from the actual soundings of the lake made by your committee, on the 25th day of May, 1846, in presence of several other members of your Honorable House, and may be relied on; and it affords them peculiar gratification to be borne out in their statement by an authority (on all matters of this nature) as distinguished as it is deserved, (see Capt. Bayfield's minutes of Evidence taken before a committee of the House of Assembly of Lower Canada, on the 16th day of January, 1836, Appendix to volume 45, in reference to the improvement of the navigation of lake St. Peter,*) where that officer is asked the following question: "From your knowledge of that part of the St. Lawrence, (namely lake St. Peter,) do you think it would be practicable to deepen the channel so as to allow vessels of a greater burden to proceed to Montreal than its depth at present admits?"—He replies: "yes, I think it possible, although I consider it a work of great difficulty." Captain Bayfield then proceeds to observe that it may be done "by excavating the present channel through the St. Francis shoal for a distance of two miles, by which, however, only six inches or at most one foot increase of depth would be gained. To obtain a greater depth, a channel must be excavated through the flats of lake St. Peter four and a half nautical miles in length, a work which would require so much time and labour, that, with the means contemplated, it is not impossible that the end first excavated might be filled up by sand washing in by the time the other was reached. The magnitude of such a work will be best understood by the statement that if it were contemplated only to obtain an additional increase of two feet in depth, and to limit the width of the excavation to 200 feet, (and it could not well be less to allow vessels to turn in, and to pass each other without risk,) no less than eleven millions of cubic feet of soil would have to be removed to effect it."

Eleven millions of cubic feet for a channel 200 feet wide is equal to 916,666 cubic yards for a channel of 150 yards wide, which makes only the trifling difference of 1—13th part less than the estimate made by your committee.

As a further corroboration of the accuracy of the present estimate, your committee refer your Honorable House to the

* See pages 19 to 21 of this pamphlet.

authority of a civil engineer, who has the reputation of being a man of great practical experience in his profession, and one whose position, in relation to the Works in question, gave him rare opportunities of acquiring the most perfect knowledge of every essential requisite on which to form an accurate judgment. Your committee allude to Mr. Atherton, superintendent of the works on lake St. Peter, in the year 1843. That gentleman states, in his report to the board of works, and dated the 23rd August, 1843, that the present ship channel may be improved to carry a depth of 14 feet at the lowest water, and 100 yards wide, by excavating 600,000 cubic yards; now 600,000 cubic yards at 100 yards wide is equal to 900,000 at 150 yards wide, which makes only 1—11th part less than your committee's estimate, and only 1—55th part less than the estimate of captain Bayfield.

If any additional testimony to the foregoing be requisite to convince the most sceptical of the accuracy of the present statements in relation to the amount of excavation required to complete the navigation of the present ship channel, your committee refer them to the Report of John Young Esq., of this city, a gentleman whose reputation for honor, integrity, and sound judgment, is unquestionable. The report in question is made to the secretary of the board of trade of Montreal, and states—"that having
 "been appointed by the board to accompany the commissioners
 "of enquiry into the management of the board of works, on their
 "intended survey of Lake St. Peter, I was informed by the
 "secretary of the commissioners on Thursday, the 23rd ult., that
 "those gentlemen would leave on Monday night, and requesting me
 "to invite any parties who felt interested in the works. Deeming
 "it a matter of importance that the parties who had objected to
 "the work as now carried on, should have an opportunity of
 "maintaining their views, I requested the permission of the
 "government to enable captain Boxer, R.N., captain of the port
 "of Quebec, to accompany me, which was immediately granted;
 "I also invited captain C. L. Armstrong, of the steamer Lord
 "Sydenham, and the branch pilots, Coté & Hamelin.

"On Tuesday we held the survey, and the following remarks
 "are based upon the information obtained during that survey:

"The whole length of the straight channel now being dredged
 "is about nine and a half miles from deep water to deep water.

"Up to the present time, three and a half miles have been dredged, and in about two or three months, I think that a channel of the above length will be completed 150 feet in width and fourteen in depth, that is, when there is eleven feet of water in the shallowest part of the lake."

Mr. Young then estimates that the excavation, required in the natural channel, to make it navigable the entire length for vessels drawing 14 feet of water, (with the exception of a bar of 150 feet wide which would only require a few days more to deepen,) and 150 feet wide, to be 352,000 cubic yards, which is equal to 1,056,000 cubic yards for a channel 150 yards wide, making it one sixteenth part more than the estimate made by your committee.

After this concurrent testimony in reference to the amount of excavation required to complete the navigation of the old channel, your committee may now safely be permitted to refer to the expense for completing the new channel. By the report of the board of works for the year 1846, at page 12, (page 93—of this pamphlet), under the head of lake St. Peter, it appears—"that the object aimed at is to open from end to end a channel of 150 feet wide, with not less than 14 feet at the lowest water." The said report also states "that on the three and a half miles the excavation has been made of the required breadth, with the exception of two or three places for a short distance, in which the breadth is little over 100 feet;" it further states "that the sum of but £23,403 2s. 5d. would be chargeable to the work already effected, and £38,000 for the outfit." Now presuming that the channel for that distance be fully 150 feet in breadth, it would require the sum of £46,806 4s. 10d. in addition to that already expended, to complete it to the required capacity of 150 yards in width, and from the end of the said three and a half miles down to the deep water, the amount of excavation required is 996,701 cubic yards which may be accomplished, (by the same principle of calculation as that adopted on estimating the expense of the old channel,) for the sum of £28,531, making the amount for excavation on the new channel £98,740 7s. 3d., to which must be added, in the case of either channel, the diminished value of the outfit of £38,000 before mentioned, in proportion to the time occupied in perfecting the operation of the respective channels.

It also appears by a return (bearing date the 20th day of May, 1846,) to an address of your Honorable House to His Excellency the Governor-General, praying that His Excellency would cause to be laid before your Honorable House the particulars relative to the expenditure of the sum of £58,000 sterling, granted by the act of the 4th and 5th Victoria, chapter 28, for deepening Lake St. Peter, that the balance of that appropriation unexpended is £4,907 4s. 3d. Your committee now refer to the report of the Commissioners of Enquiry into the management of the Board of Works to His Excellency the Governor General, dated the 14th day of May, 1846, and in page 81 (page 99 of this pamphlet,) we find it thus stated, "from the same sections, calculations of the time and "expense necessary to extend the new channel to 300 feet wide "by 14 feet deep, have also been made, and form the basis of "the last report of the chairman of the Board of Works on this "subject."

From this document it also appears that the sum of £30,000, over and above the present appropriation, will be required to obtain this desirable end—so says the report.

Your committee will now recapitulate the respective sums expended, or in anticipation of being expended on this new channel.

From the report of the Board of Works for 1846, to which your committee have before alluded, you have the sum of £23,403 2s. 5d. already expended, for labour; £4,907 4s. 3d. on hand unexpended, and £30,000 the additional sum required, making an aggregate amount of £58,310 6s. 8d.; and all this to complete a channel only 100 yards in width, which is equal to £87,465 10s. for a channel 150 yards wide, which is only 1-8th part less than the estimate made by your committee, and this, be it remembered, is gleaned from your official documents furnished by the chairman of the Board of Works.

Your committee will now allude to the evidence given before them by a gentleman who stands deservedly high in his profession as an experienced officer, and seaman; Captain Boxer, R. N., states: "That he fully agrees with Mr. Young on the general "view he takes of the subject," and further proceeds to observe: "I am decidedly of opinion that it would be dangerous in the "extreme for vessels to pass through a channel of about 3 miles

"in length and no greater breadth than 150 feet wide, under almost any circumstances; indeed it would be madness to attempt it, taking into consideration the variable winds and sudden squalls prevalent on the lake during the period when this channel would be required, and I consider a channel in a straight line with the river above, would be more dangerous as a ship channel than the old one; and I am still decidedly of that opinion, for the rafts and river craft of every description would then be compelled to use it, from the increase of current that must naturally take place when that channel is made navigable for large vessels."

The judicious observations made to your committee by J. D. Armstrong, Esq., master of the steamer Montreal, are worthy of particularization. He states "that in consequence of the shallowness of the water on the bank of a certain portion of the new channel, passage steamers and small craft could not give sufficient room to tow steamers with ships, to ensure safety to both; that a ship at anchor, riding athwart the current with a strong easterly wind, would so far block up the channel as to render it dangerous for other vessels to pass her, and that rafts passing through the new channel, which at times would be inevitable, would completely block it up;" and in reference to the old channel, he observes that "if the small bar above the first light-vessel were removed, a channel of 1,500 feet wide and 17 feet in depth would be obtained down to the lower light-vessel; thus affording for a distance of $4\frac{1}{2}$ miles a channel 1,050 feet more in breadth and fully three feet more in depth than is contemplated to be dredged in the new channel. I am therefore decidedly of opinion, laying aside pecuniary considerations, that the old channel should be improved from the lower light-vessel down to deep water."

Your committee, therefore, always keeping in view monetary considerations, (that the trade of Montreal may not be unnecessarily burdened,) have failed to discover any rational motives for the adoption of the new cut, in preference to the improvement of the old channel, and can only imagine that such decision may have been made, and the work proceeded with, without any estimate of the relative expense of the respective channels.

The increasing importance of the trade of the port of Montreal

makes it imperative to prosecute with vigour the improvement of the navigation of the lake, and render it accessible to ships of greater burden; the practicability of which is evidently apparent to your committee.

Your committee were, and still are, most anxious to obtain copies of the communications, made by the Chairman of the Board of Works to Captain Bayfield, Captain Beaufort, and J. M. Rendel, Esq., Civil Engineer, which drew from these gentlemen their approval of the new cut in preference to the old ship channel, but have failed to obtain them, although the Chairman and Secretary of the Board were respectfully desired to furnish them. Your committee are apprehensive that, from some source unknown to your Committee, those eminent authorities have been impressed with some misapprehension in relation to the subject submitted for their consideration; and your committee are the more impressed with this belief on referring to Mr. Rendel's communication to Captain Beaufort, dated the 16th February, 1845, wherein he terms the new cut rather a restoring of the old channel, and speaks of going on with the excavation on the lake during the winter season.

Your committee are of opinion that if the new channel be completed, that, in consequence of the extreme shallowness of many parts of its extreme verge on either side, on which there will not be four feet of water, rafts, particularly stave rafts, which frequently draw considerably more water than four feet, will ground and block up the channel; but the old ship channel is not open to such objection, having no less than 11 feet on its margin throughout the entire route.

Your committee, in summing up the statement herein contained, take leave to represent to your Honourable House the result of their investigations; which thus appears: If it be determined on, now, to abandon the new channel and improve the navigation of the old ship channel, as contemplated and recommended by your committee, an expenditure of £44,788 may be saved to the province.

All of which is, nevertheless, most respectfully submitted,

J. T. WILLIAMS, *Chairman.*

COMMITTEE ROOM, June 1st, 1846.

MINUTES OF EVIDENCE.

COMMITTEE ROOM,
18th May, 1846.

Committee met. Mr. Armstrong in the Chair.

Mr. JOHN MILLAR, called in, and examined :

1. Were you master of the ship or barque "James Campbell," in the beginning of October last?—I was.

2. Was your ship towed through the new channel in Lake St. Peter, and by what steamer, and were you on board, and did the same steamer take you to Quebec, and what was the amount of tonnage and lighterage paid by you?—I sailed to the head of Lake St Peter, and there a small boat belonging to the Board of Works towed my ship through the new channel, and to Quebec. No tonnage or lighterage was paid by me.

3. Have you ever stated that there were ten inches more water in the new channel than in the shallowest part of the old one, and by what authority did you make this statement?—As far as I can recollect I stated that there was about 4 inches more water in the new channel; my reasons for saying so, are that my ship struck hard on both bars of Flat Island.

4. Are you aware that tides influence the rise of water in Lake St. Peter, and is it not known among pilots that, apart from the influence of the tides, the water in Lake St. Peter and the Flat Islands is the same?—With easterly winds the water rises in the lake, but with westerly winds and dry weather there is very little difference.

5. Admitting the depth of water to be the same in both channels and admitting the new channel to be 300 feet wide, would you prefer being towed, in company with two or three other vessels, through the new channel rather than through the old one?—I would, and 300 feet would be large enough for three vessels, but not to meet.

6. From the experience you have had of passing through the new channel, would you consent to have your ship towed through it by one of our fastest tug-boats at her best speed?—Yes, I would, and would also sail through.

Mr. ZEPHIRIN BOUDREAU called in, and examined:

7. Were you the pilot of the "James Campbell" when she went through Lake St. Peter in October last?—Yes, I was.

8. Do you know the nature of the banks on both sides of the new channel at its upper entrance and what is it?—At the entrance I was told it was sand, but Capt. Millar and myself sounded on each side of the 150 feet, and found $4\frac{1}{2}$ feet of water with mud bottom.

9. Would you undertake to pilot the ship "James Campbell" through the new channel in tow of one of the strongest tug-boats, or would you undertake to sail the "James Campbell" through, or any other ship of her tonnage?—I would not consent to be towed at full speed, nor would I undertake to sail through.

19th May, 1846.

Mr. PIERRE COTÉ, a "Branch Pilot," called in, and examined:

10. Were you present at a survey of Lake St. Peter on or about the 28th April last, and by whom were you requested to go down; and have you, in any way, a knowledge of the report drawn up by John Young, Esq., to be correct?—I was present on the 28th April, and was requested by John Young, Esquire, to go with him. I have acknowledged Mr. Young's report to be correct, and have also signed it.

11. Were you informed by Mr. Atherton that he had made a report to the Board of Works, in which, after making two surveys of the channel now dredging and the old channel, he stated that the old channel should be deepened; and do you think that opinion correct?—I was, and I sounded the lake three or four times over, and I am decidedly of opinion that the old channel is the best. Mr. Atherton reported the same to the Board of Works, with whom I was surveying, and being at the same time in the employ of the Trinity House, I reported to them that the new channel could never be made to meet the expectations of the trade.

12. What will be the distance saved by the proposed new channel; and are there any places between Quebec and Montreal, which are more crooked than the old channel, and name the most prominent?—The distance saved will be about half a mile, and there are a great many places more circuitous, viz.: Pointe-aux-Trembles, Ile à la Bague, Pointe à Picot, Cap à Laroche, Richelieu.

13. Did you try the strength of the current in the new channel on the 28th April last, and what is the difference between the rate at which it runs, and that of the old channel?—The current in the new channel is not so strong as in the old channel.

14. Would you undertake to pilot a vessel of the tonnage of the James Campbell through the new channel in tow of one of the strong tug-boats, or would you undertake to sail through?—I would not undertake to do so upon my own responsibility.

15. When you pass the little bank, called the Traverse, near the lower light-vessel, do you steer in a direct line for Pointe du Lac, and if so, is there as much water in this channel as if you kept farther to the southward, on a straight line with the new channel?—After passing the Traverse, we steer direct for Pointe du Lac, and there is quite as much water as in keeping farther southward in a straight line with the new channel. Ships in tow and under canvas frequently take this direction, and we never go to the southward for deeper water.

CAPT. RAYSIDE, called in, and examined:

16. By the report of the Chairman of the Board of Works laid before the House last session, it appears that you, on the 19th November, 1844, accompanied by Capt. Vaughan, proceeded to sound Lake St. Peter; by what authority did you do so, and which of the pilots branched for the navigation of the St. Lawrence between Quebec and Montreal, accompanied you?—By the request of Capt. Vaughan, I proceeded to Lake St. Peter, and took the soundings. On that occasion no branch pilot accompanied us.

17. On that occasion you gave the difference of water between the natural channel and that now dredging as being 12 feet 7 inches in the former, and from 13 feet 6 inches to 14 feet 6 inches in the latter. Did you on that occasion, to arrive at the conclusion to which you came in the said report to the Chairman of the Board of Works, sound the old channel?—We did not on that occasion sound the old channel; we only sounded the new channel, and found the soundings as laid down in the chart of the Board of Works.

18. Can you state what the depth of water is, at low water, from the Sorel Islands to the lower light at Rivière du Loup in the old channel, and what its breadth is, and what is the depth of water in the channel now dredging from the Sorel Islands to a point opposite Rivière du Loup?—I cannot state.

19. Can you state what the depth of water is, at low water, from the lower light at Rivière du Loup to deep water in the old channel, and what is the depth of water in the line of the channel now dredging from the point opposite to Rivière du Loup to deep water?—I cannot say.

20. Have you been master of steamers on the St. Lawrence; if you have, will you inform the Committee if it be the case that you have frequently towed up three or four square-rigged vessels, and sometimes more at one time?—I was master of a tug steamer for two years, and towed nearly all the ships coming to Montreal; I have towed seven vessels at one time.

21. Are not ships liable to sheer about when they come in shoal water, and do not accidents frequently arise from their so sheering; what breadth would you consider necessary for the safe passage of such vessels?—Ships do not steer so well in shoal water.

22. Does it not frequently happen that, owing to storms, fogs and gusts of wind, a steamer is obliged to let go her tow and come to an anchor, and even passage boats?—Yes, it frequently happens.

23. Do you think it possible that square-rigged vessels could, in stress of weather, ride with safety in a channel of 150 feet or even 300 wide, on each side, of which there was not more than four feet of water, and how could these vessels be got under way, once at an anchor?—I do not think so.

24. Would you think it safe for steamers coming from Quebec and Montreal respectively, each with vessels in tow, to meet in a channel of 150 feet wide?—Yes, I think steamers with vessels in tow could easily pass each other.

25. Are you aware that the breadth of the generality of rafts going to Quebec is from 700 to 1,200 feet?—I cannot say.

26. From your experience, are you not aware that rafts generally range towards the southern shore where the channel is now dredging?—It depends altogether on the wind.

27. Would it be possible for the master of a steamer or ship entering the new channel to see whether a raft was at the other extremity of it, and, in the event of meeting a raft, how would the steamer or ship get out of the new channel?—The answer does not appear in the minutes.

28. Is the old channel correctly drawn in the chart of Lake St Peter, published in the report of the Board of Works, laid before the House last session?—I cannot say.

29. What is the nature of the soil at the upper extremity of the new channel, and what is the depth of water on its banks when there is eleven feet in the shallow part of the lake?—The upper part of the channel is clay; I cannot say anything about the depth of water.

30. Do you conceive that the line now pointed out to you on the map of the Board of Works, which leads from the small traverse opposite to Rivière du Loup into the line of the new channel now dredging, or otherwise called the new channel, is correct, and that ships must follow that course to have the deepest water down to Point du Lac?—I conceive that the line referred to indicates the proper channel for ships, and, in fact, that is the course that ships do and must follow.

CAPTAIN VAUGHAN called in, and examined:

31. Are you Superintendent of the works going on in Lake St. Peter, and how long have you been in that employ?—I am, and have been since January, 1844.

32. Did you not, accompanied by Captain Rayside, take soundings in Lake St. Peter, in what is called the new channel, or the channel now dredging?—I did.

33. Did you not furnish the Board of Works with those soundings, and have they compiled them in the map found in their report of 1845 upon your report?—These soundings were furnished by me; I cannot state positively whether the map found in their report was compiled from the report sent in by Captain Rayside and myself, but I believe it was.

34. Were you accompanied by a branch pilot when you took the soundings?—I was not, as the pilots were unacquainted with this channel, it being the straight one marked out by Captain Bayfield and Mr. Killaly.

35. When you got the pilots to sign a petition in favor of a straight channel, did they or any of them make no observations as regards the merits of the old and new channel, or rather the dredging of a new channel?—The pilots whose signatures I obtained to the petition would, at that time, prefer the straight channel when made as marked out by Captain Bayfield and Mr. Killaly; the chart was one traced from Captain Bayfield's. I beg to state, however, that the pilots, apprehensive that the straight channel would tend to reduce their rates of pilotage, have since endeavoured to oppose the new channel, as they state that it resembles a road balised.

36. What is the distance from where you are now dredging, in a parallel line, to the lighthouse opposite Riviere du Loup?—About $1\frac{1}{2}$ or 2 miles.

37. Can you state the number of days lost in 1844, from derangement of machinery?—Not without referring to the log-book of that year.

38. From evidence before the committee it appears that you victual the men—does not this take up a good deal of your time?—It does not, as provisions are served out to them every Saturday night after work, but I may state, as a reason for victualling the men, that, on my return from Prince Edward's Island with Captain Bayfield's report to Mr. Killaly, I found several accounts were sent to him by Mr. McNee, of Sorel, and others, who had given provisions to the parties who victualled the men employed

on the different vessels; these parties received the amount of their claims from the Board of Works, and to this day have not settled with Messrs. McNee and others. Mr. Killaly, thus finding that the persons who victualled the men did not pay up their accounts, stated to me that he would hold me responsible for all accounts in future. I may also state that the board of the officers at that time was from £3 to £4 per month. I stated to Mr. Killaly that engineers, captains, and officers should fare alike, and that £2 10s per month was sufficient, which is the amount they have received since that period. The men's board amounts to £2 per month.

39. Do you conceive that the line now pointed out to you on the map of the Board of Works, which leads from the small traverse opposite to Rivière du Loup into the line of the channel now dredging, or otherwise called the new channel, is correct, and that ships must follow that course to have the deepest water down to Point du Lac?—The line is not correct, as it is not at all necessary for ships to steer for the new channel, and so far as my experience has gone, (and I have had a good deal,) I have never witnessed ships taking such a course, and I must suppose the line in question has been the result of an error on the part of the person or persons who drew up the map referred to, and now before me.

ROBERT MCKINN, Master of the steamer *St. Peter*, belonging to the Board of Works, employed in Lake St. Peter, called in, and examined:

40. Are you aware that a raft got aground early in the spring of 1845, on the piles laid down by the Board of Works in one of the channels?—Yes, I am aware that rafts have grounded on the piles as laid down in the map, on the south side.

41. Can you inform the committee why the dams and groins, as proposed to be made in the report of the Chairman of the Board of Works, laid before the House of Assembly last session, have not been made?—I cannot say.

42. Have you reason to believe that when Captain Millar, of the *James Campbell*, passed through the new channel early in

October last, that there was four inches more water in it than in the old, as stated by him?—I have reason to believe that there was four inches more water.

43. When did you cease working last autumn, and when and where did you begin this spring?—We left off working at the south buoy last autumn, and we commenced at the third buoy.

44. Have you this spring dredged where you left off last fall?—We have, but it was to deepen still more, and to widen the channel.

WILLIAM HUNTER, engineer, called in, and examined :

45. Were you in the employ of the Board of Works, in Lake St. Peter, in the year 1843, and in what capacity?—Yes, I was.

46. Were you in the same employ in the year 1844?—Yes, I was.

47. Do you consider that the dredging can be done faster in the old than in the new channel, and would the wear and tear of the machinery be more or less?—I consider that excavation could be done much easier in the old than in the new channel, and much less wear and tear would take place in the old than in the new channel on account of the soil.

48. What amount of time was lost in the year 1844 from bad weather and from repairs to be done to the machinery?—Three and at most four weeks from May to close of navigation.

49. To what cause do you ascribe the fact that the machinery got out of order?—From the fact that sand grinds down machinery more than any other clay substance.

50. Are you of opinion, from the nature of the soil where you dredged, that the channel will not fill?—Cannot give an opinion founded on experience.

51. How long will it take to make the new channel 600 feet wide and 14 feet deep at low water, from the Sorel Islands to Rivière du Loup?—Cannot say; but my opinion is, if as much stuff had been taken from the old channel as what has been dredged from the new, we would now have as perfect a channel

in Lake St. Peter as is required to meet the difficulties found in other parts of the river, and I believe that this would not have cost as much, as the soil is more favorable for dredging in the old than in the new channel.

WILLIAM HUNTER, again called in, and examined :

52. Were you employed for any length of time by the Board of Works, and will you state how long and at what time ?—I was employed from the 15th February, 1843, to December, 1844, in the Board of Works, and left of my own accord.

53. Do you remember what dredging was done in 1843, and where it was done ?—We dredged about three days work at different times and periods in the old channel, not however with a view, as I understand, to commence a regular line, as the season was too much advanced, but as all our guiding buoys were laid down in the old channel, we fully expected to commence early in the spring ; at least so I understood from Mr. Atherton.

JOHN YOUNG, Esquire, called in, and examined :

54. Were you appointed by the Board of Trade to visit the works on Lake St. Peter ?—Yes.

55. Did you proceed to these works, and when, and what persons accompanied you ?—On the 28th ult. I proceeded to the works going on in Lake St. Peter, in company with Capt. Boxer, R.N., and Capt. C. L. Armstrong, of the steamer Lord Sydenham, and the branch pilots Côté and Hamelin. All these parties went at my request, except Captain Boxer, who refused to go, unless by command or permission of His Excellency the Governor-General, and that I obtained. Messrs. Redpath and Hayes, Commissioners of Enquiry into the management of the Board of Works, Mr. Ferres, their Secretary, and Mr. Killaly, President of the Board of Works, were also present.

56. Did you draw out a report of your proceedings ?—Yes.

57. Was the report concurred in by all the persons who accompanied you ; if not by all, state by whom ?—Capt. Boxer

and Capt. Armstrong concurred in my report, so also did the pilots Coté and Hamelin, in so far as it related to the soundings.

58. Can you furnish a copy of the report in question to the Committee?—The report was given to the Board of Trade, and is now subject to their orders.

59. Were copies of that report transmitted by you or any other person to the Board of Works and to the Board of Trade?—A copy of my report was asked for by the Commissioners of Inquiry and refused, on the ground that the Board of Trade did not wish to interfere with any report which the Commissioners might deem it their duty to make.

60. As a member of the Board of Trade, can you state what action was taken upon your report?—The report was received and entered upon the minutes of the Board, and is now open to the inspection of all members.

61. Can you state whether any observations were made as to the rate the current runs in the channel now dredging?—A log was taken on purpose to ascertain the current, and upon trial by Captains Boxer and Armstrong it was found to be about $1\frac{1}{4}$ knots.

62. Can you state whether you made any inquiries from the Superintendent of Works, whether he had dredged this spring in that part of the channel where he had dredged last season?—Enquiry was made, and the reply was that there had not been any dredging this spring in the place referred to.

63. Are you of opinion, from your observations, that it would be better even now to deepen the natural channel?—Previous to my visiting the works referred to, I was under the impression both by the reports of the Superintendent, and from a chart of the lake published by the Board of Works, that there was now at least one foot more water in the new than in the old channel; observation has satisfied me that this is not the case, and that for about 6 miles below the lowermost point where dredging has been done, there is in both channels, as near as possible, an equal depth of water. I believe the agricultural interest of Upper Canada is deeply involved in having the communication between Quebec and Montreal made navigable for ships of large burthen, and it is of vast moment to the trade that this should be done in the most permanent way. Scientific men, who understand the laws regu-

lating currents and deposits, may see in this opening up of a new channel, results that I cannot. A large sum of money has been expended in making a channel through banks of clay, $3\frac{1}{2}$ miles long by 150 feet wide and of 14 feet deep in low water, which it will require some three months to finish, and as by the report of the Board of Works it will require to be made 300 feet wide. I am of opinion that it would be better to lose all that has been done in the new channel and deepen the old one, for, on a parallel line with the $3\frac{1}{2}$ miles referred to, the old channel is 1,500 feet wide, and from 18 to 20 feet deep (with the exception of a bar of about 150 feet). Were the work to begin on the old channel, I have no doubt from calculations which Mr. Redpath made, that it could be made available to the trade for 14 feet in low water by *eight months' work*.

64.—Can you give any further information to the Committee?—If there is any other question which the Committee might wish to ask me upon this subject, I shall be happy to answer it.

CAPTAIN BOXER, R.N., called in, and examined :

65. Have you at any time been engaged in sounding Lake St. Peter previous to the operations of the Board of Works in dredging out the new channel; if so, state when, by what authority, and the result of such examination?—I was never engaged sounding Lake St. Peter previous to the operation of dredging out the new channel, but I had several conversations with Mr. Atherton on the subject, and I approved of the plans proposed by him, although I always had had my doubts as to the practicability of keeping the channel open, without a considerable after expense for raking and dredging; and having subsequently been to England, I brought out with me a model of a rake (which was used in cleaning out the new channel in Liverpool Harbour) given to me by that able surveyor, Lieut. Lord, R.N. This model I gave to Mr. Atherton.

66. Have you at any subsequent period been engaged in the examination of the old and new channel; if so, by whom were you

accompanied, and what was the nature of the report of such examination; and to whom did you report such examination?—In 1844 I was employed with Colonel Holloway on an important survey of the River St. Lawrence, by direction of the Home Government and sanction of the Governor General, and in the course of our proceedings we sounded very particularly both the new and old channels in Lake St. Peter, and finding a very great difference between my soundings and those on the plan furnished us by the Board of Works, I felt it my duty to call the attention of His Excellency to the subject, which was acknowledged by the Civil Secretary, who informed me His Excellency had forwarded my letter to the Board of Works for their information. I herewith enclose, with two plans of my soundings, an extract of my letter to him. In that survey I was accompanied by two very intelligent officers, Lieut. Moody, R. E., and Mr. Taylor, late Master Attendant at Kingston Dockyard, by whom as well as by myself, every possible care was taken to be correct in our remarks, by taking a sufficient number of angles at different points where we sounded to secure accuracy. I beg to observe that from the time we sounded the new channel, a week elapsed, before we sounded the old, and found the waters of the Lake had in that time risen a foot, which must, of course, be added to the soundings on the plan of the work of the preceding week. On the first day of our survey the *Great Britain* passed down the old channel, drawing 11 feet 5 inches, without touching the ground; at the same time we found not more than 12 feet throughout the lake, thus corroborating my view that there is not more than a few inches less in depth than in the lake, and that only in the small traverse.

Extract of a letter from Captain Boxer, R.N., to Captain Higginson, civil secretary, for the information of His Excellency the Governor General.

“Since we had the honor of forwarding the memorial above alluded to, I have examined and sounded the intended new channel in Lake St. Peter, having been furnished by the Board of Works with their survey, which I understand was taken in the winter, on the ice, but it differs so much from my sounding,

“ (and as this is a question purely naval and commercial, and of
 “ so much importance for those purposes) that I also consider it
 “ my duty to forward to His Excellency my survey, which shews
 “ clearly, (and I was very particular in sounding), that there will
 “ not be more than a few inches water gained by the new over
 “ the old channel, and even then it is a question whether it will
 “ not fill in again, or be materially altered by the spring freshets
 “ of the Yamaska and St. Francis rivers. I am of opinion it will ;
 “ at the same time, the gain will be so trifling that it cannot be
 “ worth the immense outlay (at least £150,000) in dredging
 “ through the shoal water, (it being surrounded with difficulties) ;
 “ for when a ship is unloading or loading to 12 feet, it is of little
 “ consequence whether it does so to a few inches lower, and that
 “ only in their second voyage, there being sufficient water in the
 “ spring; and it appears to me it would be a dangerous experiment
 “ to attempt to deepen the channel to 17 feet, for, if successful, it
 “ would in my opinion lower the water at Montreal, for the shoal
 “ now acts as a dam for the river above in the dry season, and there
 “ are shoals in that harbor with no more water than in the lake.
 “ It must be observed also that a channel in a straight line from
 “ the river would be more dangerous as a ship channel, as the
 “ whole of the rafts and river craft of every description would
 “ then use it, and it might be blocked up occasionally, if not of
 “ sufficient width, whereas, at present, the old channel is quite
 “ clear of them.

“ Under all these considerations it appears to me of great im-
 “ portance that before any further outlay takes place the new
 “ channel should be regularly sounded, buoyed and examined by
 “ professional and competent navigators, to ascertain the extent
 “ of the difficulties to be contended against, and the superiority
 “ of the new over the old channel, and whether the gain, when
 “ achieved, would be sufficient to justify this great expenditure ;
 “ and should such survey be thought advisable, it should be
 “ taken at the lowest water in the dry season, and the two chan-
 “ nels sounded at the same time, as on my examination, a rise of
 “ water took place very suddenly, being affected by strong easterly
 “ gales and the spring tides, which I understand affect the waters
 “ on the lake at all times, and if Captain Bayfield could be spared
 “ from his professional duties in the Lower Province, to attend

" this examination, the question might at once be set at rest, for
 " there is no officer in Her Majesty's service so well acquainted
 " with the localities of the lakes, rivers and Gulf of St. Lawrence
 " as that officer, from his laborious and important surveys in this
 " country.

" (True copy.)

" EDWARD BOXER,
 " *Captain, R. N.*"

67. Have you seen the report of John Young, Esq., on the deepening of Lake St. Peter, and do you coincide as to the facts stated therein; or, if you differ from that gentleman, will you inform the committee upon what points?—I have seen Mr. Young's report, and fully agree with the general view he takes of the subject, except in some of the minor details, as I think he has underrated the time and expense which would be required to complete the new channel to 150 feet width and 14 feet depth. It is necessary your committee should be informed that, at the request of Mr. Young, by the direction of the Board of Trade of Montreal and the sanction of the Governor-General, and also at the request of the Commissioners of Enquiry, I accompanied the party, but took no active part in the examination, which was taken by the commissioners, Mr. Young, Captains Vaughan and Armstrong and two pilots; I merely tendered my advice as to the best mode to effect a complete and satisfactory examination; I have no doubt the survey taken by these gentlemen will be found very correct, as the greatest pains were taken to obtain the desired object, and the weather was extremely favourable for that purpose.

68. Is it not essential to the navigation, for sailing vessels, that the new channel must be made at least six times its present breadth to enable them to stay, or ride, at anchor without danger? Most certainly.

69. If the new channel were completed throughout, to its present breadth, would you prefer it to the old one?—As this is a

question which none but sailors can decide, it will be proper to examine pilots and masters of vessels on that particular point. I am decidedly of opinion that it would be dangerous in the extreme for vessels to pass through a channel of about 3 miles in length, and no greater breadth than 150 feet, under almost any circumstances; indeed it would be madness to attempt it, taking into consideration the variable winds and sudden squalls prevalent on the lake, during the period when this channel would be required.

70. Do you know the strength of the current in the old and new channel on the 28th April?—It could not be ascertained very exactly by the log at the time mentioned, but it certainly did not exceed $1\frac{1}{2}$ miles per hour, both channels being as nearly as possible of the same force.

71. State your principal objections to the public expenditure on the new channel?—The answer to this question requires serious consideration, for the expense of making a new channel of sufficient width and depth of water to answer the general purposes of the trade would, in my opinion, be so great as to justify its immediate abandonment, taking into consideration that the old one could be made, with but little expense, a safer and better channel, its breadth being 1500 feet, and deep water to the Little Traverse except a small bank above the first light-house, which would require very little expense in dredging; the expense, therefore, of clearing a channel from that point, from which the water is of the same depth throughout, until you arrive at the deep water in the lower part of the lake, would be of no material difference in either channel. I beg also to refer the committee to my letter before alluded to, wherein I have stated that I consider a channel in a straight line with the river above would be more dangerous as a ship channel than the old one, and I am still decidedly of that opinion, for the rafts and river craft of every description would then be compelled to use it from the increase of current that must naturally take place when that channel is made navigable for large vessels, whereas at present, the old channel is generally clear of them, and it would be absurd to suppose any law made to prevent it could be put in force, which the Commissioners of Enquiry consider could be done. I beg also

to observe that a curve channel has an advantage over a straight one at night, from the facility it affords of ascertaining whether vessels are approaching or going from you, which is difficult to ascertain in a straight one, and collisions would be likely to take place in consequence. It is also of importance that no time should be lost in completing a channel through the lake, not only for the commercial interests, but for the general defence of the province; this also is another strong argument, why the old channel should be preferred to the new; as it can be completed in a much shorter space of time.

72. Are you aware that Messrs. Redpath & Hayes, the commissioners on the Board of Works who proceeded to lake St. Peter, pronounced any opinion as to the merits or demerits of the old or new channel previous to their entering upon its survey?—I am not aware of any such opinion having been expressed by either of these gentlemen, although they appeared decidedly in favor of the new channel.

73. Was every assistance given you by the commissioners to enable you and others to ascertain the facts necessary to be known, to come to a correct conclusion?—Every assistance was afforded.

74. Are you acquainted with one William Hunter, an engineer, lately in the employ of the Board of Works, and now in that of the Commissariat Department; if so, will you state how long you have known him, and in what capacity, and if you think him a credible witness?—I have only known Mr. Hunter since his engagement as engineer of the Union; I have found him a very steady, trustworthy man, and an attentive clever engineer.

75. Did you hold any further correspondence with the Home or Provincial Government in consequence of the letter of the Chairman of the Board of Works to the Governor General on your representation of the different works carried on in the Province?—Yes, and I herewith enclose an extract of my letter to the Governor General in reply to one received from the Civil Secretary, dated the 15th May, 1845, enclosing a letter from Mr. Killaly, and a letter from the Secretary of the colonies, calling upon me for explanation upon some remarks I had made on the general works of the Province, but more particularly that of lake St. Peter to which I received no reply.

Extract of a letter from Capt. Boxer addressed to the Civil Secretary, in reply to a letter received from the Governor-General, dated 15th May, 1845, enclosing a letter from Mr. Killaly, and one from the Secretary of the Colonies.

JUNE 4TH, 1845.

“ On our survey down the river from Montreal to the Pillars, we examined Lake St. Peter, and I was very particular in doing so, as I felt satisfied from much that I heard, as well as from documents then in our possession, which had been furnished to us by the Board of Works, that Mr. Killaly had been deceived by the reports which had been made to him; and which was proved as by sounding, when I found only 12 feet where 17 was laid down, and only 6 or 7 inches difference in depth, between the two channels; whereas the survey we had received from the Board of Works, shewed a difference of 2 feet; and in the Plans, in the Appendix to the Board of Works' general report, dated December, 1844, from a survey taken November last, about 18 months subsequently to the commencement of the works, 11 inches difference, only is laid down. These discrepancies shew the incorrectness of their plans.

“ I again felt it my duty to report to the Governor General, accompanying my report, with plans, having my soundings marked on them, signed by myself and certified by Lieut. Moody, R. E.

“ With reference to my remarks as to the cost of deepening of lake St. Peter and the other shoals adjacent, it was of course prospectively, and under the impression that the work was intended to be, as originally proposed, of a width and depth, for a practicable channel for loaded ships to pass through, at the driest season of the year; and I am still of opinion that such a channel cannot be completed under any less sum than I have named: in the general statement of the Board of Works' report, the sum of £32,893 19s. 3d. is set down, as the total amount expended to the 1st July, 1844. In the body of the report itself the sum of £5,534, only, is named as the amount actually chargeable to this work; credit having been unfairly taken for £27,291, for the value of vessels and materials applicable to

"other works, whereas, all these may be worn out, and useless, long before the present work is completed, and from the great draught of water of most of the vessels, they can be of little or no service in the shoal parts of the lakes St. Louis and St. Francis; the statement thus made of £5,534 as the amount of expenditure actually chargeable to this work up to the 1st July, 1844, is singularly at variance with Mr. Killaly's observations dated 21st February 1845, wherein I find the following statement "In addition to what is there stated, I have only to say, that an *actual* expenditure upon the *work*, to the present, is about £5,000," notwithstanding a period of seven months has passed, during which very considerable expense has been incurred.

" EDWARD BOXER,
Captain, R. E."

STEPHEN YARWOOD, Esquire, called in, and examined :

76. Have you been engaged in the works now going on in Lake St. Peter; and where and by whom are you now employed? Early in the year 1843, the works on the Gosford Road, where I had been employed the preceding year as paymaster, being near completion, I received an appointment to the Lake St. Peter establishment, by a letter from the secretary of the Board of Works, dated 22nd April, 1843; and I am now employed under the said Board as paymaster of the Arthabaska and other roads on the south side of the St. Lawrence.

77. What cause was assigned for dismissing you from the employment in Lake St. Peter; by whom were you succeeded?—In the month of September, 1844, I most unexpectedly received a letter from the secretary of the Board of Works, acquainting me that my services would no longer be required; a copy of said letter I furnish herewith, as the most proper reply I can afford to the first part of this question. Shortly after I had closed my accounts I learned that Mr. R. J. Begley had succeeded to the duties which had formerly been entrusted to me as paymaster of the Lake St. Peter establishment.

78. Have you any knowledge who was the contractor for the feeding of the men employed by the Board of Works in Lake St. Peter in the year 1844?—In the year 1844 Captain Vaughan had the entire management of the victualling of the people employed in the Lake St. Peter service.

79. Is the David Vaughan you mention the same who is the superintendent of the works?—Captain Vaughan was at that time, and is, I believe, now, the superintendent of the works.

80. Do you think it proper that the Superintendent should be the contractor; or do you not think these offices incompatible?—With every deference to the authority which decided otherwise, I am of opinion that the duties of superintendent and of contractor for victualling should not be confided to the same person; my long service in the civil and military departments, and of the navy may perhaps have induced this opinion, as in the naval departments every care is taken to keep separate command from inferior responsibilities.

81. Did you ever mention the subject to Captain Vaughan and to the chairman or secretary of the Board of Works?—The former superintendent, Mr. Atherton, having been much dissatisfied with the modes of victualling which had obtained during the season of 1843, and prior to his supercession, consulted me on the subject, and I suggested that it would be well that the management of the victualling and charge of the stores should be imposed on the paymaster; this was approved of by Mr. Atherton. After I found he had been relieved from his duties I considered it a duty, (not being aware that any other satisfactory mode had been proposed), to submit my views on the subject, which I did in a letter to the secretary dated 9th February, 1844.

82. Which, in your opinion, would be the best plan to feed the men employed in the lake?—I am of the same opinion now that I entertained at the time I wrote my said letter of the 9th February, that the paymaster should furnish the provisions and all other stores under properly authorized requisitions; that he should cause the provisions to be carefully and timely issued through the medium of the storekeeper and a trustworthy steward afloat; and a strict accountability should be required from every one to whom any description of stores may be issued,

by which the paymaster's return of supply and expenditure would clearly show how and for what purpose every article had been consumed or converted: all of which appears to me might be done under proper regulations, at no greater cost than at present incurred for the same service, and thus leave the superintendent free to administer the executive duties of his office, un-embarrassed with the detail of distribution of provisions, and even to satisfy the people under his orders.

83. Can you furnish any information to the committee respecting the works going on in Lake St. Peter?—I have no further information to furnish the committee respecting the works going on in Lake St. Peter.

[COPY.]

Board of Works, Montreal, 16th Sept., 1844.

SIR,

As the works in your section of the Province, which require the services of a paymaster, are now completed, or rapidly drawing to a close, I am instructed to inform you that after the 1st of November next the Board consider it will not be necessary to retain any person in that capacity, and will not from that date require your services.

In notifying you of your discontinuance, I am directed to express the satisfaction of the Board at the manner in which you have discharged the duties of your office, and the zeal and attention you have at all times evinced in forwarding the public interest.

I am further desired to state that the Board will feel happy should a future opportunity offer in rendering your services available.

I have the honor to be, sir,
Your very obedient servant,

THOMAS A. BEGLEY,
Secretary.

To S. Yarwood, Esq.,
Paymaster Lake St. Peter Service.

OLIVIER RAYMOND, branch pilot, called in, and examined :

84. When you pass the little bank called the Traverse, opposite Rivière du Loup, near the light vessel, do you steer in a direct line for Point du Lac, and if so, is there as much water in the channel as if you kept further to the southward in a line with what is styled the new channel?—Quite as much water as anywhere to the southward, and, in piloting ships, I have never thought of seeking more water to the southward of a straight line to Point du Lac from the south of the little traverse. I seldom have been so far south in coming up or going down as to be in a line with the line of the new channel.

85. Did you not, along with many other branch pilots, sign a petition in favour of what is styled the new channel?—In the winter of 1844 Mr. Vaughan called upon me with a petition, which he represented as bearing a desire to have a straight channel in Lake St. Peter; I said I had no objection to sign the petition for a straight channel from the little traverse, opposite Rivière du Loup down to Point du Lac, and, if that part of the channel in the lake was dredged, more ships would go to Montreal, inasmuch as above the Rivière du Loup light there was from 16 to 20 feet water to the Sorel Islands, with the exception of a bar of about 150 feet, which could be dredged in ten days, as it is but a hog's back. I never would have signed for the channel as now dredging, as I had expressed my opinion of the absurdity of the scheme, and I know that all the pilots who signed the petition were under the same impression that I was, and are further convinced that the new channel will be the means ultimately, if persisted in, to prevent that alone which is required to make the channel good from Montreal to Quebec, and analogous to other parts of the river, by the deepening of the channel from Rivière du Loup to deep water in a line with Pointe du Lac.

JOSEPH BOYER, Pilot, called in and examined :

After hearing the evidence of Raymond, he concurred in all he said; he further states that it would be impossible for any ship, from his knowledge of the ground, to find its way in a line, as

drawn in a chart by the Board of Works, which leads from the old channel below the light at Rivière du Loup to the new channel, because there are several small sand banks.

86. Did you not, with several other pilots, sign a petition in favour of the new channel, at the requisition of Capt. Vaughan?—I did, but previously remarked that if a straight channel were cut it would cost a great deal of money. He answered that money was no object, all he wished to know was whether I did not prefer a broad and straight channel. If I had known that this money was to come out of the provincial chest I would never have signed the petition, but I consider that it will never be equal to the old channel, and I further believe that the best line of work would be to abandon this new channel and start from the lighthouse opposite Rivière du Loup in a line to Pointe du Lac. I have frequently seen rafts ashore there.

DAVID BOYER, Pilot, called in, and examined :

87. Were you engaged in surveying Lake St. Peter with Mr. Thompson, and how long?—I was, and for six or seven weeks.

Answer to Ques. 84. Yes, and there is more water.

Answer to Ques. 85. Same as Raymond—that a schooner was lost on those banks, and that the sand covered her over.

20th May, 1846.

LAURENT JUSTINIEN, Master of the *Queen*, called in, and examined :

88. Are you a pilot branched for the navigation of the St. Lawrence between Quebec and Montreal, and what is your present employment?—I am a branched pilot, and am now master of the steamer *Queen*.

89. Did you at any time sign a petition in favor of the channel now dredging in Lake St. Peter; what were your reasons for so doing, and at whose instance did you sign it; and are you aware if the said petition was signed by others, and at whose instance and for what reasons?—Same answer as by Joseph Boyer.

First question put to Raymond, read; the same answer given.

90. What difference is there in the depth of water in Lake St. Peter in the month of May, or thereabouts, and in the month of September or thereabouts?—It varies in different years from eight to ten feet.

MR. JOSEPH ROSS called in, and examined :

91. Have you not for many years employed men to unload rafts of timber and staves, and can you state the depth of water rafts of timber and staves generally draw?—I have been in that trade for many years, and from experience I have found rafts to vary from two to five feet, but most generally from three and a half to four feet.

CAPTAIN SWINBURN called in, and examined :

92. Are you aware that the old channel in Lake St. Peter is 1,500 feet wide, and that the new channel is 150 feet wide?—I cannot say.

93. Would you prefer to have your ship sailed or towed down to Rivière du Loup or the lower light-vessel in the old channel or by the new channel now dredging?—I would prefer a straight channel if it is broad enough.

94. Would you consider a channel of 150 feet wide a safe passage for several ships in tow of a steamer?—I cannot say.

95. Are you sufficiently acquainted with the depth of water in Lake St. Peter to state the soundings in different parts, and especially the depth in the new and old channels?—I cannot say.

96. Do not ships steer wild when near the ground?—Yes, ships do steer wild when in shallow water.

97. What breadth of channel do you suppose would be necessary for steamers to meet, with each several ships in tow?—A channel of 600 feet.

CAPTAIN MORTON being called in, and the six immediately preceding questions put to him, gave the same answers as Captain Swinburn.

DANIEL MCCARTHY called in, and examined :

98. Were you ever engaged in sounding Lake St. Peter, and, if you were, with whom?—I was, previously to the spring the dredging commenced, in the month of March; I accompanied Capt. Vaughan and took soundings through the ice at distances of from 250 to 500 feet, in the new channel only.

99. Did you sound the old and new channels; if not, will you state why?—I only sounded the new channel.

100. Were these soundings correctly reported by you to Capt. Vaughan, and were they transmitted to the Board of Works as given by you; or were they in any way altered by you or by any other person to your knowledge?—I cannot state whether my soundings were correctly reported, but I can now produce the soundings as then taken.

101. Do you know if the Board of Works have a yard opposite Sorel; what is the value of the yearly rent thereof, or of a yard which would be as suitable?—I cannot state.

102. Is the repairing of the dredging machine or the building of new ones done by contract; if not, do you think it advisable that it should?—I cannot state.

28th May, 1846.

THE HON. H. H. KILLALY, President of the Board of Works, called in, and examined :

103. Will you favor the committee with the perusal of copies of all correspondence had by you with Captains Bayfield and Beaufort, of the Royal Navy, and also with James Rendel, Esq., C.E., in relation to the deepening of the channel of Lake St. Peter?—I have already laid before the committee, in compliance

with their request, all the communications between me and these gentlemen; and those letters, together with my previous reports, contain all the correspondence that passed between us.

104. Did you submit to the gentlemen mentioned in the last question an estimate of the improvements you suggested on Lake St. Peter, distinguishing the amount required to complete the present ship channel to 14 feet depth, and the amount required to complete the channel subsequently adopted by you?—No, I never furnished any estimate of either of those channels; the amount set down in the appropriations was not in any manner suggested by me, but had been, as I believe, embraced in the estimates by the request of the mercantile interest of this city.

105. Has any portion of the second 150 feet in the new channel been excavated?—Yes.

106. What number of cubic yards have been excavated on the second 150 feet of the new channel?—I had a measurement made of the amount excavated in the second breadth of 150 feet. The amount I do not correctly recollect, but I will furnish the committee with it.

107. Look at the plan of the section now under the operation of the dredges, furnished by you to the commissioners appointed to report on the works of lake St. Peter, (exhibit 1,) and inform the committee if that be correct?—It is perfectly correct, to the best of my knowledge.

108. Will you inform the committee who is the author of the chart of the new cut on lake St. Peter, furnished by you to this committee, and in which the soundings of Capt. Boxer, R. N., are in red ink, (Exhibit No. 2)?—The chart referred to in this question was furnished to the Board of Works by Captain Vaughan, and the soundings marked in black ink are his. Those in red ink, I understand to have been marked by Captain Boxer, R. N.

109. Do you believe the soundings thereon marked, in black or in red ink to be most correct?—Not knowing the relative period at which these soundings were taken, I cannot give a decided answer to this question; but, judging from the depth of water I see marked on the shoal, I would think that the water must have been very high in the lake when the soundings which the black figures indicate were taken. And from the red figures I consider

that the lake must have been at or near its lowest period, when the soundings marked in red were taken. The difference in the levels of the lake would account for the discrepancy.

110. Have you seen the evidence of Captain Bayfield, R. N., given before a Committee of the House of Assembly of Lower Canada, on the 16th January, 1836, on the subject of improving the navigation of lake St. Peter?—Yes, I read it about two years ago.

111. Do you coincide in the views expressed by Captain Bayfield in his examination before the said committee?—There are some parts in his evidence in which I agree with him and in others I dissent.

112. Are you of opinion that it would require eleven millions of cubic feet of excavation to improve the present ship channel in lake St. Peter, as contemplated by Captain Bayfield, or do you think that that officer's estimate is overrated?—I think it very much overrated.

113. Have the goodness to refer to that part of your report to the Legislative Assembly for the year 1844, which relates to lake St. Peter, where you state that by a moderate calculation the quantity of soil carried off by the current is equal to that lifted up, and state to the committee whether you now affirm that assertion?—The opinion referred to in this question was based upon the comparison between the amount of excavation done, as ascertained from the measurements furnished me, compared with that of the aggregate amount of scow-loads discharged would appear to give, and as the latter did not at all equal the former, I concluded that the surplus quantity must have been carried off by the stream. I do not think that the proportion is by any means as great as is therein stated, but I believe a large percentage is carried off, which percentage I calculate will increase according as the cut is carried clear through.

114. Refer also to that part of your report wherein you state that it requires stiff pulling to get across the cut of the new channel without drifting much, in consequence of the obvious and serious increase of the current. Do you now give your affirmation to that assertion?—I do.

115. What depth of water do you expect to have in the sum-

mer season, when the waters of lake St. Peter are at their lowest level, on the north line of your new cut at section 14, when the channel is completed?—The plans submitted to the committee will show four feet two inches, which I believe to be true.

116. And what depth of water, at the same season of the year when the new channel is completed, will you have on the south line of section 16?—The chart will show.

117. And what depth of water, at the same season of the year, when the new channel is completed, will you have in the north line of section 21, to section 24, and on the south line from 25 to 30?—From section 21 to 24 would vary from 6 feet 2 inches to 6 feet 9 inches, and from 25 to 30, 7 feet 6 inches.

118. And what depth of water at the same season of the year, when the new channel is completed, will you have on the south line of section 14?—Five feet six inches.

119. And what depth of water at the same season of the year, when the new channel is completed, will you have in the north line of section 16?—Four feet eleven inches.

120. And on the south line of section 17?—Four feet two inches.

121. And on the north line of sections 18, 19 and 20?—Five feet 2 inches, 5 feet 2 inches and 5 feet 4 inches.

122. And what water on the south line of section 18?—Four feet eight inches. With reference to the shallow depths immediately on the sides of the cut stated in answer to the foregoing questions, I am of opinion that the navigation of the channel will be rendered very much more facilitated thereby, as I conceive that did the water shoal away gradually from the channel, that vessels would be much more likely to get out of it and run aground.

123. What is the greatest depth of soil through which you have excavated in the new channel?—I believe the greatest depth to be between nine and ten feet, on the highest point of the St. Francis shoal.

124. What is the nature of the soil so excavated?—Generally I would pronounce it to be a bluish clay, with a small portion of very fine sand.

125. Are you apprehensive that it will continue to maintain the depth of the excavation?—I am persuaded that the channel will be annually improving; when once opened clear through, the current will be permitted to pass through it.

126. Do you conceive the blue clay to be the natural bed of the lake or is it of recent deposit?—I am of opinion that the soil, such as I have described it, is a deposit of very old date, and I have not been able to discover any traces of recent deposit.

127. How remote a period do you attribute to this deposit?—I cannot say.

128. Refer to that part of your Report which states that the Buoys on the new channel, which mark the locality, are now kept under water from the strength of the current?—The buoys that marked the channel at this period of the Report were solid, (of timber,) and several of them were kept down by the strength of the current.

129. Are the present buoys in that channel so affected by the influence of the current?—The present buoys are fourteen feet in length, formed of boiler plate; they are immersed in about 6 feet, and having very heavy weights attached to make them stand.

130. Is the ice in the winter season, in the general surface of the lake, frozen on the shoals down the bottom?—I have been informed that it is, and I believe it is so.

131. Was dredging ever commenced in the old channel, and can you state why it was discontinued in the year 1843?—One of the steam vessels was reported to me, by the then Superintendent, to be ready to make trial very late in the fall. He received instructions to test the perfection of the machinery, and having found all fit for use, immediately to lay the boats up at Sorel. I am not aware in what part of the lake the trial took place. I know of no dredging having been done except in the new channel; but in compliance with the directions referred to in the foregoing, the Superintendent reported having tried the vessel, but whether this trial was made in the line of the old channel or new I cannot say.

132. Was it not then decided by the Board of Works what line of operation on Lake St. Peter was to be dredged; and was Mr. Atherton instructed to dredge in any particular part when his

machinery would be completed?—The line was not decided; on the contrary, Mr. Atherton was informed that the Board were by no means satisfied with the course he proposed to take, but as the time had arrived for the laying up of the boats, every means to procure information during the winter would be taken, and full consideration given to the line to be adopted prior to the commencement of operations in the spring.

133. What depth of water did you find on the flats referred to in the answer to the third question, and what depth will there be in what is considered low water?—From five to seven feet of water, which I consider to be the lowest found on that bank.

134. Who was the person employed to take soundings on Lake St. Peter, by the authority of the Board of Works?—Captain Vaughan and Captain Rayside, on one occasion, to verify the soundings taken.

135. Has any portion of the groins, as laid down in the map furnished by the Board of Works, been completed, and is it the intention of the Board of Works to stop the different channels and outlets leading north, from the north and south shores of the River St. Lawrence?—A portion of the groin is completed so far as the timber materials are concerned; it is intended to discharge more of the dredge stuff in the front of them; it is not now intended to stop any other channels but the two main ones, which are now piled.

136. What depth of water at the driest season of the summer do you believe to be on the little bank in the Old Ship Channel a short distance this side the first light vessel?—I believe it is about 11 feet 4 inches.

29th May, 1846.

Hon. Mr. KILLALY's examination continued:

* 137. Are you of opinion, after the experience of two years operations on Lake St. Peter, that you were correct in selecting the New Cut in preference to improving the Old Ship Channel?—Every hour's experience convinces me more and more in the propriety of the present.

138. What is the greatest depth of soil that would require removal by dredging in the present Ship Channel, to attain 14 feet of water in the dry season.—The greatest depth is 3 feet 2 inches.

139. What is the greatest depth of the soil excavated or to be excavated in the New Channel?—The greatest depth that has been excavated is, I believe, between 9 and 10 feet; speaking of the channel, the committee inform me that by the channel they mean a breadth of 300 feet; I find on the extreme verge of the channel, in section 16, about 3 feet 8 inches, consequently, on that particular point there would be 10 feet 4 inches to be excavated; but at that same section, the water ranges from 15 to 19 feet.

140. Have you made an estimate of the expense of completing the present ship channel to 14 feet deep, at the lowest water mark, and if so, what is the amount of such estimate?—No, I have made no estimate, but from my knowledge of the shoals and depths in the Lake, I am of opinion that a channel of 14 feet depth could be made through the present Ship Channel at about the same cost as the completion of the straight channel; but I can see considerable difficulty in carrying on the operations in the present Ship Channel, arising from these operations being necessarily carried on in the immediate line of the trade, nor do I think the channel, if completed, so likely to be kept clear by natural and artificial means as the straight one.

141. Will you have the goodness to inform the Committee of the nature of the difficulties you now allude to?—The difficulties would be created from the circumstances of the works being necessarily proceeded with on the line that vessels are hourly passing, thereby interfering with our moorings, &c.

142. Have you made an estimate of the expense of completing the new Channel throughout, as contemplated by you, and will you favor the Committee with such estimate?—I have an estimate of completing the new Channel throughout upon two principles; one, confining its breadth to 150 feet, the cost of which would be, (as stated in my report), about £8,500 in addition to what has already been laid out. I also estimated the cost of making the Channel three or four hundred feet wide, which would amount to £20,000 beyond the cost of completing the 150 feet channel.

143. How many cubic yards of excavation would it take to make the present Ship Channel 150 yards broad, and 14 feet deep at low water?—I would require a detailed measurement of the whole channel to answer this question.

144. And what number of cubic yards would require to be excavated from the commencement of the operations on the new Channel, to its completion, to make it of equal dimensions with that specified in the preceding question?—It would require also, in this case, a detailed measurement to answer this question. This measurement has never been made, inasmuch as it was not contemplated by the Board to increase the Channel beyond the breadth of three hundred feet by means of dredging.

145. And what quantity of excavation would it require to make it 300 feet wide, and 14 feet deep?—This quantity has been measured and stated in my report to the commissioners; with regard to this information practically it may be gathered from my statement that the operations for two years after this season would effect it, the remainder of the season being necessary to complete the 150 feet channel.

146. If it has been stated by you to the commissioners, then state it to the committee.—I would require to look at the report to answer this question.

147. What report do you allude to, and of what date?—I allude to my report to the commissioners as already stated, of a recent date, a copy of which I can furnish to the committee, if not before them.

148. When can you furnish the committee with such report?—To-morrow.

149. Previously to commencing the work in the new channel did you lay before the Legislature your plans and estimates of costs for the new channel, and did you state the reasons why you differed from Mr. Atherton in his report in favour of the old channel?—I stated in reply to the question yesterday, that the appropriation for lake St. Peter did not proceed from any report of mine, nor was it based on any estimate of mine; but it originated with representations from the mercantile interest of the city. With respect to either channel, I had no communication with the Legislature. The amount having been granted, (as

I conceive), towards the effecting of a deep and navigable channel through the lake, and upon receiving Mr. Atherton's report in preference of the crooked channel, I immediately expressed my dissent, and it being at the very close of the season, instructions were given him merely to test the machinery, and to lay up the boats, and during the winter, prior to the season for the commencement of operations, the Board would collect the best information they could as to the channel to be taken.

150. Did you then collect informations on the subject, and from whom?—I sent a special messenger to Prince Edwards Island, in order to have the benefit of Captain Bayfield's opinion upon the subject; I also had the opinion of Captain Douglas and of some of the most intelligent pilots and ship-masters, all of which confirmed me in the propriety of making the straight channel.

151. The dredging being evidently of a description not difficult to be done, what is the worth per cubic yard for dredging?—Last year it cost about 1s. 5d., but this year I think it could be done for 1s. or 1s. 2d.

152. Why was the work on lake St. Peter not done by contract, as all other public work has been, and thereby saved the great expense of £38,000 for the outfit?—I was of opinion that, whether it were done by contract or otherwise, the cost of the outfit must in reality have been borne by the Province, inasmuch as the work is so situated that no suitable dredge or other vessels could be brought to it, and must therefore have been built expressly for it; any person coming forward to contract for the work would of course have covered the cost of his necessary outfit by his prices. Moreover, no man would enter upon the cost of such outfit without having ensured to him a certain amount of work by which the country would be tied to the undertaking, however it might be found likely to turn out. By the course adopted, the power is had of stopping at any moment, and the whole of the outfit could be transferred to the dredging and improvement of the harbours upon the lake, almost every one of which stands in great need of it.

153. By what authority was the work on the lake St. Peter undertaken on the present system of day's work—was it upon

the authority of the Executive Government, or had the matter been first submitted to the Government, and its sanction obtained?—There were several discussions upon the matter at the time by the Board of Works, the members of which were also members of the Executive Government.

154.—As there are many other parts of the navigable channel of the river not straight, why was it necessary to dredge a straight line in this particular place?—I have already given at large in my report the reasons that induced the Board to adopt the straight channel, the principal of which are, 1st. The power of working unobstructed by the passing trade. 2nd. The much greater probability of the stream of the river acting with beneficial and increased effect.

155. As it is admitted a wide, though somewhat crooked channel is to be found running nearly parallel, and with an equal depth of water with the straight one now making, why did you not therefore commence dredging at the point where the two channels meet at the lower end, and dredge downwards through the shallow water, which must be deepened in any case—leaving the part now making until it was clearly ascertained the old or crooked channel would not answer?—A considerable portion of the work was calculated upon to be effected by diverting as large a body of water in the line of the proposed channel as possible, to effect which the channel was commenced with considerable increased width, and the groins undertaken as recommended by Captains Bayfields and Beaufort.

156. Was Mr. Atherton acting as engineer of the works on lake St. Peter, from the 18th September, 1841, to the 31st. August, 1843, at the sum of £300 per annum, and also from the 1st. September, 1843,, to the 29th of February, 1844, at £400 per annum?—He was.

157. Was Mr. Atherton during any of the period included in the preceding query employed in any other capacity under the Board of Works, and if so, in what capacity, and at what salary or other remuneration?—He was, as engineer to the Lachine Canal, at the same period, at a salary of £400 per annum. His united salary was, I think, either £750 or £800 per annum.

158. It is stated in your return to the commissioners, that the

services of G. Meldrum, as dredge master, have been dispensed with by Captain Vaughan, while it appears that John Cass & William Fleming have succeeded to similar appointments. Can you state the cause why you return "the officer (dredge master) dispensed with by Captain Vaughan," when in fact the officer has not been dispensed with, but changed?—The office has been dispensed with; when employed, was not attached to either boat, but was appointed as a description of general dredge master, which office was considered supernumerary, and therefore dispensed with.

159. David Vaughan is returned as superintendent of the works on lake St. Peter at a salary of £500 per annum. Will you inform the committee, if Mr. Vaughan is a civil engineer or a scientific man, or why he was chosen in lieu of Mr. Atherton, and at an increased salary of £100 per annum, exclusive of perquisites?—David Vaughan was appointed at the express request of Sir Richard Jackson; he was considered the most eligible man for the situation, from his knowledge of the lake, his having acted as steamboat captain; had the confidence of government for being a man of great energy of character. The salary was increased by my authority without reference to the Executive Government. It was considered just to do so in consequence of rates paid to men who had much less duty to perform.

160. Stephen Yarwood is returned as "Paymaster" to the works of lake St. Peter, in 1843 and in 1844. Can you inform the Committee why a Paymaster was required for this particular work, and if required, why his salary was increased from £30 per annum in 1843, to £200 per annum in 1844?—The salary was increased in consequence of increased duty on other works.

161. Denis O'Brien and James State are returned as "Store Keepers" to the works on lake St. Peter. Can you inform the Committee what are the particular duties they have to perform as such Store-Keepers?—There is but one Store-Keeper; the former was dismissed, the latter replaced him. He has in charge the yearly supply of coals and firewood, iron, steel, oil, and all ship stores.

162. Wm. Hunter is returned as "Superintendent of Machinery," from February, 1843, to 30th November, 1844, and as

having his services afterwards dispensed with. Can you inform the Committee why his services were dispensed with, while the services of Asa Martin, of David Hood, and of John Tuck, were subsequently, (to wit in August and September, 1843), taken on as Engineers?—Hunter was in much the same position as Meldrum, and was considered as a supernumerary officer.

MR. BEGLY, Secretary of the Board of Works, called in; and examined:—

163. Are all communications made to the Board of Works, whether regarding works under contract or performed by the Board of Works, and all letters whether of complaints against or to the Board of Works, regarding any officer or officers of that Board, and applications for employment in the Board of Works, in your custody, or are they, or any part of the said documents, left with the Provincial Secretary?—All letters previous to the latter part of December, 1845, were received by me and kept in my custody; since that period the letters have been received and opened by the Chairman of the Board of Works, and I believe that they do not all come into my hands. Relative to letters referred from the office of the Board of Works to the Secretary of the Province, they are sometimes returned and sometimes retained by that officer, as the interests of the public service may require.

164. Have you any knowledge of any communications made by the Chairman of the Board of Works to Capt. Bayfield or to Capt. S. Beaufort, or to James M. Rendel, Esq., Civil Engineer, in relation to the improvement of the navigation of lake St. Peter previously to or subsequent to the adoption of the line of the New Channel, portions of which communications appear in the report of the Chairman of the Board of Works for the year 1844, page 8?—I am not aware of ever having seen the original letters, but I have seen extracts from them in the report of the Chairman of the Board of Works.

165. Was an estimate made of the expense of completing the New Channel on lake St. Peter previously to the commencement of the work?—I don't remember having seen any estimate.

166. Then you cannot say that the Chairman of the Board of Works furnished the Commissioners of Enquiry with any such estimate?—I cannot say, as I have never seen it, but can ascertain.

167. Have you any book in your office in which such documents are entered, and if so, will you furnish the Committee with such estimate?—There is such a book, and, if there is an entry of such a document, I will furnish the Committee with a copy of it, with all convenient speed.

30th May, 1846.

MR. BÉGLY re-examined :

168. Have you examined the books and documents in your office of the Board of Works, and have you found the estimate mentioned to you in the examination of yesterday?—I have examined the books, and don't find any such estimate.

169. Have you examined the records in your office, and have you found copies of the letters from the Chairman of the Board of Works, to Capt. Bayfield, Capt. Beaufort or James M. Rendel, Esquire, Civil Engineer, on the subject of the improvement of lake St. Peter?—I have made the examination, and do not find any such record.

JAMES MOIR FERRES, Esq., called in; and examined :

170. Are you Secretary to the Commissioners of Enquiry into the management of the Board of Works?—I am.

171. Has any preliminary estimate of the expense for completing either the Old or New Channel in lake St. Peter, been furnished by the Chairman of the Board of Works to the said Commissioners, during any period of the sittings of the said Commission?—No. In addition, I beg to say that Mr. Killaly, in his letter transmitting his papers relative to lake St. Peter, explained that, from the nature of the work, it was considered impracticable to make out estimates of the nature mentioned in question, until they should have some experience of the work.

QUESTIONS TO J. D. ARMSTRONG, ESQ., MASTER OF THE STEAMER
"MONTREAL."

172. From the experience you have of towing ships to and from Montreal to Quebec, will you state to the Committee the relative advantages of the proposed New Channel now dredging in lake St. Peter, allowing the New Channel to be fourteen feet in depth, and one hundred and fifty yards (450 feet) in breadth, as compared to the Old Channel, allowing the Old Channel also to be deepened in such places as it may be required to fourteen feet, and be widened to one hundred and fifty yards also where required.

CAPTAIN ARMSTRONG'S REPLY.

MONTREAL, 30th May, 1846.

SIR,—In reference to certain questions put to me by your Committee as to the relative advantages of the New and Old Channels in lake St. Peter, I beg leave to give the following answers:—

1. As regards the New Channel: That ships when near the ground, sheer about a good deal, and would be in danger of running aground or foul of each other in a Channel of one hundred and fifty yards wide,—that such danger would be very much increased when two tow steamers would meet with several ships in tow, each,—that in consequence of the shallowness of the water on the banks of certain portions of the New Channel, passage steamers and small crafts could not give sufficient room to tow steamers with ships, to insure safety to both; that a ship at anchor, riding athwart the current with a strong easterly wind, would so far block up the Channel as to render it dangerous for other vessels to pass her,—that rafts passing through the said New Channel, which I consider at times to be inevitable, would completely block it up.

2. In reference to the old channel: That if the small bar, (which I understand can be dredged in six days), above the first

lighthouse were removed, a channel of fifteen hundred feet in breadth would be obtained, and of seventeen feet in depth down to the lower lighthouse, thus affording for about four and a half miles, a channel of one thousand and fifty feet more in breadth, and fully three feet more depth than is contemplated to be dredged in the new channel. As to the circuit or bend as I would style it, it has its inconvenience in distance only; the new channel would be a saving in that particular, of three-fourths of a mile. In other respects, and especially in running at night, vessels could be seen with more accuracy in the old than in the new channel, as in the latter they would necessarily be in a straight line.

I am therefore decidedly of opinion, laying aside considerations of cost, that the old channel, from its having throughout at all seasons of the year, not less than eleven feet water, and in breadth no place less than fifteen hundred feet, should be improved from the lower lighthouse down to deep water. I have come to this conclusion, from the first part of my answer, and because there would then be a channel of fourteen or fifteen feet, for four miles and a half of one hundred and fifty yards in breadth, on each side of which would be found eleven feet water, sufficient for steamers, rafts, (and even ships except in the months when the water is low,) and for five miles above the lower lighthouse there would always be sufficient water for ships to ride to their anchors, and to get under way, and from my experience in taking ships in tow, this wide and deep channel I consider indispensable, and should not therefore, in my opinion, be condemned.

I am, sir,
Your obedient servant,

J. D. ARMSTRONG.

To the Chairman Committee of Inquiry, on Lake St. Peter.

Extract from the "MIRROR OF PARLIAMENT."

5th June, 1846.

Mr. Williams went into a long detail of statistics to prove the expediency of improving the old channel in preference to the new channel. His proof was altogether drawn from the report of the Committee of that House on the subject.

Mr. ARMSTRONG:—It was used as an argument in favor of the new channel, that it would save seven miles, when now it turns out there will only be a saving of half a mile, or at most one mile, and there is now much less current in the new channel than in the old. **Mr. A.** read part of the evidence of Captain Rayside, and showed how it was contradicted by the evidence of other parties and the soundings taken by the hon. member for Durham, who had sounded every four minutes, though the Captain of the steamboat did not wish to steer to these particular places, to which he was requested, and he (**Mr. A.**) was reminded of the quarter deck, when the hon. member (**Mr. Williams**) ordered him to go to those places that were pointed out to him. (Laughter). This was the way that other parties had been deceived with respect to the depth of the water in the different channels, as they had been steered to those parts only where there was deep water. Captain Vaughan said in his evidence, that the line as given in the report of the Board of Works, was not correct, and yet it was on the faith of the correctness of this line that Captain Bayfield had recommended the new channel as being preferable to the old. By deepening the old channel, you would have given the trade of Montreal a broad channel of 1,500 feet and thereby much time would be saved in towage, as no steamboat would venture to tow up more than one ship through the new channel. **Mr. Williams** could not exemplify the absurdity of the operations in Lake St. Peter, better than by stating, that in the navigation of the St. Lawrence between this and Kingston, there are several points which project into the river, and an individual, instead of improving the natural channel, should say, "Oh, the Province has plenty of money, and I am determined to get to Quebec in as straight a line as possible." **Mr. Killaly** complains of not being treated with proper courtesy by the Committee. Now he (**Mr. W.**) could appeal to every member of the Committee, whether every respect was not paid to him? Their questions were framed in this spirit, for they said, "Will you favor," "Will you be pleased," etc? And it was not until he found that **Mr. Killaly** would not give them some information that they desired, that he was obliged to say, "You are compelled to answer." He (**Mr. W.**) wanted to save a useless expense of money, and he had no feelings to gratify further than to show that he was qualified to perform the duty

that the House imposed upon him. He did not consider that the members of the Commission of Enquiry were so competent to give an opinion on the relative merits of the channels as he was, from his profession. The new channel can be carried out the width of 150 feet for £9,500, but it will only be a partial benefit.

Sol. Gen. SHERWOOD did not intend to defend the Chairman of the Board of Works, or to enter upon the discussion with respect to the relative merits of the different channels. But he considered that the House could not decide the question on account of the conflicting reports, and that it was better to leave it to the Government, who will certainly make proper enquiries before going on with the work.

Mr. ROBINSON.—It is some consolation to him and the hon. member for North Lincoln, to know that there is a deep cut in Lower Canada as well as in Upper Canada. If they were now about to commence the work in Lake St. Peter, he would certainly be of this opinion that the old channel ought to have been improved, and the work have been begun at the lower part instead of at the upper end, as has been done. The work ought also to have been given out by contract, and it would then have been finished much sooner and cheaper. It would, in his opinion, be advisable to do the remainder of the work by contract; there was a person in Boston who would do the work for one shilling a yard, and the dredges, which are superior articles could be profitably employed in the Harbours of Upper Canada and Montreal. No contractor would pay £500 to a foreman, as the Board of Works has paid Captain Vaughan, the superintendent of this work, besides allowing a certain sum for the board of the men. He was not inclined to stop the work; that would be penny wise and pound foolish, but he would test this narrow channel first, and leave it to the Executive to take such steps as will keep the money from being thrown away.

MR. McDONALD OF GLENGARRY:—It will require a dredging machine to clear away the rubbish that has been created by the argument on both sides; he was in favour of the amendment, for it left it with the Government to decide upon the best channel, and they will be responsible to this House.

Several of the captains of the regular traders of this port have given their opinion in favour of the new channel, and he was afraid that a great deal of the opposition to the new channel was

the result of a combination to injure the trade of Montreal, by keeping it at Quebec. If £9,500 would make the new channel available, he was very willing to vote that sum; he did not consider that there was any danger of rafts grounding on this new channel, as he knew that very few rafts go to Quebec after the month of August, when the water is low. Mr. Moffatt would feel great reluctance to abandon the straight channel, as such a channel had certainly advantage over a crooked one if it could be made for any thing like a reasonable expense; he (Mr. Moffatt,) regretted that this as well as other public works had been undertaken before proper surveys and estimates had been made, he would leave it to the government to decide this question after they had caused further examination to be made by competent individuals.

MR. MERRITT.—Spoke in favour of the grant of £9,500 being laid out in continuing the straight line. Mr. Draper said that he felt greatly embarrassed by the question as it then stood. Before the report drawn up by the committee of the House in favor of the old channel was presented, the objections to the new cut had not assumed a tangible shape; now, however it was different and there was evidently a necessity for further enquiry. After all he had heard, he felt that he had no right to ask the House for a grant specifically for either channel; the appropriation of any further money could only take place after renewed enquiry, and on the responsibility of the government.

MR. BALDWIN, said that after the conflicting evidence that had been adduced he could not at that moment pretend to decide as to which channel was most eligible; he would prefer that the sum proposed to be voted should be laid out in such a way as would be available, be the final decision what it might; but as he understood that could not be done, he saw no course but to leave it to be appropriated upon the responsibility of the government; he did not wish to prevent the improvement of the lake, nor could he, as the case then appeared, consent to tie the minister's hands; they should proceed upon their own judgment and responsibility.

The vote was then agreed to; the appropriation to be made by the government in favor of either channel as they might determine upon.

Dredging operations in the new straight channel were suspended on the 8th of June, 1846. The following extracts of correspondence and reports contain an account of the closing of the work and the steps that led to its resumption, by order of the Governor in Council, dated 22nd September, 1846 :—

BOARD OF WORKS OFFICE, 30th May, 1846.

SIR,—

I take the liberty of acquainting you for the information of His Excellency the Governor-General, that the day before yesterday I received a communication from the Secretary of this Department informing me, by direction of one of the members of the executive, that there would be no further grant of money for the works now being carried on on Lake St. Peter; and that therefore it was necessary that the expenditure should not be allowed to exceed the amount already appropriated. By the statement of the Secretary to me, the balance in hands is about £2,070; to clear, up to the 31st of the present month, would require about £1,000, and that upon the difference, there might be some demands at present unforseen.

Under these circumstances, it becomes my duty to state that to continue to expend any portion of this balance would be utterly useless. No profitable result whatever would be had from it, as unless the sum of £8,500 is granted and expended in completing the channel, nothing whatever of practical utility is obtained, and therefore I humbly conceive any further expenditure of the balance in hands would be unjustifiable. Under these circumstances, I have to request that I may, as soon as possible, be made acquainted with the decision of the Government as to the immediate stoppage of the work and as to the course which is to be adopted with regard to the outfit, vessels, machinery, materials, etc. I trust I will be excused in respectfully recording my opinion of the extreme inexpediency of permitting work to be dropped in its present state of forwardness where, after an expenditure of £61,000, the comparatively trifling sum of £8,500 only is required to carry a channel of 150 feet in width clear through from deep water to deep water. This, although it would leave the channel of only half the breadth I think it ultimately should

be, would, in conjunction with a small excavation to be made at *La Bature*, be of great importance to the trade, the interests of which, in its present crisis, cannot be too carefully attended to.

It would permit deeply laden vessels to pass up to and down from this city, thereby lightening the taxes on the trade resulting from the cost of lighterage, cooperage, injury to produce, especially flour, from the present frequent transshipments of it, &c.

It would afford two channels instead of one, lessening the risk of collision thereby. It would render the past expenditure of £61,000 available, which, with the exception of the value of the vessels and machinery, will have been utterly thrown away if the work is now abandoned; and I am satisfied it would establish the fact beyond all question or cavil that this straight channel would not only keep itself open, but would annually improve. In favor of the channel adopted and the course of operations pursued, the highest naval authorities in England have given their opinions. The operations have also received the approval of two members of the executive who personally inspected the work last season. And the special report of the Commission of Enquiry instituted by the Government has very lately, in the strongest manner, expressed their concurrence with all that has been done and recommended that the sum of £8,500 required for this year should be procured. I have not been furnished with a copy of the estimates for this year to be submitted by the executive, but I am respectfully of opinion that, without increasing the amount to be asked for this year, this item might be substituted for some other not so pressing.

I have, etc.,

(Signed,)

H. H. KILLALY.

To the Honorable the Provincial Secretary, &c., &c.

BOARD OF WORKS, 8th June, 1846.

SIR,—

I have the honor to acknowledge the receipt of your letter of the 8th instant, directing the works on Lake St. Peter to be forthwith discontinued until further orders. I have accordingly had a letter to that effect addressed to the Superintendent of the work.

I think it my duty to acquaint you at the same time, for the information of His Excellency the Governor-General, that the only saving which can be effected thereby will be the cost of fuel, oil and tallow, and which is comparatively trifling. While the delay caused by the suspension may have this effect, that should it be finally decided to prosecute the work on the line of the present, the opening of, through this season, will not be accomplished.

I have also to request instructions with regard to the procurement of coals, about 2,000 chaldrons. They were sold last week, I am informed, at, Quebec, unusually low, (20s per chaldron) but if advantage is not taken of the supply brought by the spring fleet, they will no doubt in a few days be higher; such at least has been the usual course.

Your obedient servant,

(Signed,) HAMILTON H. KILLALY.

Honorable the Provincial Secretary, &c., &c.

PUBLIC WORKS OFFICE, 18th June, 1846.

SIR,

I have the honor to acquaint you, that in accordance with the command of His Excellency the Governor-General conveyed by your letter of the 15th instant, directing that "Captain Vaughan should be called upon to come to Montreal without delay, and bring with him all his papers, etc., required for the closing of the accounts with the several parties employed on the Lake." Captain Vaughan was immediately written to and is now in Montreal. He has furnished the pay-lists and accounts which are herewith transmitted, and he states that, so far as he knows, they include all the outstanding claims at present due, with the exception of his own salary from 1st March last, and a pay-list marked No. 23 upon which the men will have to be settled with, up to the day of payment. Captain Vaughan is anxious to know if it is necessary that he should remain here.

I have &c.,

(Signed,) THOMAS A. BEGLEY.

Secretary.

Honorable D. Daly, Secretary.

MONTREAL, Sherbrooke Str., 23rd June, 1846.

SIR,

I beg leave to acknowledge the receipt of the memorandum relative to the Lake St. Peter establishment, with an order endorsed thereon that I should report by whom and under what authority the persons therein mentioned were engaged. With reference thereto I have the honor to state, that upon Captain Vaughan's appointment to the chief superintendentship of that work, (which appointment was made by the special desire of Sir Richard Jackson,) the selection of the Engineers, Captains of Dredges, and other working officers was left wholly to him, as being the person responsible for the details of the working, and best acquainted with the qualifications which were required in those under him.

On making his arrangements, Captain Vaughan found three or four officers in employment whose services he thought were not necessary, and he accordingly dispensed with them, and made such changes both as to pay and victualling as to effect much saving.

The nature of the engagements with Engineers and other such officers employed on board steamboats is, I believe, universally by the season, and those men have but little chance of procuring employment after the opening of the season, unless in case of a vacancy created by death, illness, misconduct, or some such cause.

The men selected by Captain Vaughan are of the very first class, whether as regards their conduct or qualifications,—and this was so well known, that prior to the commencement of each season attempts have been made by captains and proprietors of steamboats to seduce them from the service by offers of higher wages, which I presume were declined, on account of the hitherto supposed more permanent nature of their present employ. Those men have been, therefore, held on from year to year, and being good mechanics the necessary alterations and repairs have been effected by them during the winter without calling in extra aid. As there was a balance of the appropriation sufficient to carry on the work nearly to the middle of this season, and no appearance of any probability of the work being stopped at the proper time

for engaging men, Captain Vaughan, I suppose, considered their continuance as a matter of course, especially from not having heard anything to the contrary from the Board or from me.

I have the honor to be, sir,

Your very obedient servant,

(Signed,) HAMILTON H. KILLALY.

E. Parent, Esq.

MONTREAL, 24th June, 1846.

SIR,

In accordance with the wish expressed to me yesterday by the Committee of the Honorable the Executive Council, I take the liberty of suggesting the course which, in my opinion, would be the most advisable to adopt with regard to the Lake St. Peter works.

I conceive that an application should be made to the Admiralty to request that Captain Bayfield, now on survey in the Gulf, might receive immediate instructions to proceed to Lake St. Peter for the purpose of minutely examining both the channels, the extent of work done, &c., and to make such further observations as would enable him to report, for the guidance of the Government, as to the course it would be most expedient to adopt under all the circumstances. All the men who are employed by the month or day should be immediately paid up and discharged and the boats laid up at Sorel.

Supposing Captain Bayfield's decision to be communicated by the latter end of August, there would remain nearly three months of the working season and for this period a supply of coals (about 1,000 chaldrons) in addition to what is in hands, would be required. Coals have been selling very cheap this season (at 20s per chaldron). It might be well therefore to instruct Mr. Ryan, of Quebec, to continue to purchase to the extent of 1,000 or 1,500 chaldrons, whenever he can buy for 20s and under.

The principal part of the appropriation for the improvements

in Lake St. Francis and St. Louis is yet unexpended. These improvements consist, in part, of the removal of certain shoals, the erection of lights and the procuring and fixing of buoys.

For the first I had purposed to fit up the large square scow, now at Sorel, as a horse dredge boat with similar machinery to that now in use in the boat at Beauharnois. This I would recommend to have done at once, the men to be employed in doing so to be the four engineers and blacksmith who are under pay by the season; they are all good mechanics and can therefore be thus well and profitably employed. The other men engaged by the season, namely masters of the dredges and steamboats, I would put under Captain Vaughan with instructions immediately to continue the survey and soundings and marking out of the channel in Lake St. Louis. This operation was commenced last winter, and the channel, its depth and breadth, very accurately ascertained and laid down, from the Beauharnois canal to the opposite mouth of the Chateauguay River. But thence to the Lachine canal the channel is very intricate and not well known—the only charts of the lake are so very incorrect as to be of no use whatever, and now that a larger class of vessels is adopted, the necessity for properly fixing and buoying this channel is very urgent. Within the last month the mail steamers have grounded several times. I conceive therefore that these men will be most usefully occupied in the manner I have suggested. Some of the buoys are provided, but until the channel throughout is ascertained, the erection of the light-houses and the mooring of the buoys cannot take place. Mr. McKinn, master of one of the boats, and the mates should be retained, one on each boat, to take charge and attend to their moorings. Such I believe to be the best course to be adopted under the circumstances.

I am, sir,
Your very obedient servant,

(Signed,) H. H. KILLALY.

E Parent, Esq.

Copy of a Report of a Committee of the Honorable the Executive Council, dated 24th June, 1846, approved by His Excellency the Governor General in Council, the same day,

On the letters of H. H. Killaly, Esquire, dated 30th May, 8th June and 24th June, 1846, relative to the suspension of the works on lake St. Peter, and the several documents connected with the subject.

The Committee recommend that an application be made to the Admiralty to request that Captain Bayfield, now on a survey in the Gulf, might receive immediate instructions to proceed to lake St. Peter for the purpose of minutely examining both the Channels, the extent of the work done, etc., and to make such further observations as would enable him to report, for the guidance of this government, as to the course which would be most expedient to adopt under all the circumstances.

All the men who are employed by the month or day to be immediately paid up and discharged, and the boats laid up at Sorel.

Supposing Captain Bayfield's decision to be communicated by the latter end of August, there would remain nearly three months of the working season, and for this period a supply of coals, (about 1000 chaldrons), in addition to what is in hands, would be required; and Mr. Ryan, of Quebec, should be instructed to purchase to the extent of 1000 or 1500 chaldrons whenever he can buy for 20s. or under.

The principal part of the appropriation for the improvements in lakes St. Francis and St. Louis is yet unexpended. These improvements consist, in part, of the removal of certain shoals, in the erection of lights, and in the procuring and fixing of buoys. For the first, should be fitted up the large square scow, now at Sorel, as a horse dredge-boat, with similar machinery to that now in use in the boat at Beauharnois, the men to be employed in doing so, to be the four engineers and blacksmith who are under pay for the season.

The other men engaged by the season, namely, the masters of the dredges and steamboats, to be put under Captain Vaughan, with instructions immediately to continue the survey and sound-

ings, and marking out of the Channel on lake St. Louis. Mr. McKin, master of one of the boats and mates to be retained, one on each boat, to take charge of and attend to their moorings; as well as James State, store-keeper, and two watchmen, to take charge of the steamboats.

Certified.

(Signed,) E. PARENT.

To the Provincial Secretary.

(Copy).

ADMIRALTY, 25th July, 1846.

SIR,

My Lords Commissioners of the Admiralty having, in consequence of an application from Her Majesty's Secretary of State for the Colonies, for an examination to be made of the lake of St. Peter in the river St. Lawrence, ordered Captain Bayfield, R.N., to place himself at your Excellency's disposal, for that special service; and as the season is already so far advanced, my Lords direct me to inform your Excellency thereof, in case you may have any immediate means of communicating with Captain Bayfield, earlier than that officer may receive their Lordship's orders by way of Halifax.

I am, etc.,

(Signed,) F. H. WARD.

His Excellency the Governor-General of Canada, Montreal.

(Copy).

DOWNING STREET,

28th, July, 1846.

MY LORD,

I had the honor to receive your Lordship's despatch No. 81, of the 26th June, in which you represent the difference of opinion which prevails in Canada relative to the best ship Channel

through lake St. Peter, and request that Captain Bayfield, R.N., may be instructed to examine the lake, and furnish you with his report and opinion upon the question.

Having enquired of the Lords Commissioners of the Admiralty whether Captain Bayfield could be employed in this service, I have the satisfaction of informing your Lordship that the Board of Admiralty have instructed that officer to place himself at your disposal for the object in question.

I have, etc.,

(Signed,) GREY.

The Governor-General,

Lieutenant-General Earl Cathcart, K.C.B., &c., &c., &c.

Extract from the "PILOT AND JOURNAL OF COMMERCE."

MONTREAL, Sept. 1st, 1846.

BOARD OF TRADE.

The following memorial on the subject of lake St. Peter was presented a few days since :

To His Excellency the Earl Cathcart, K.C.B., &c., &c., &c.

The memorial of the Montreal Board of Trade humbly sheweth :

That it is of the utmost importance to the trade of this province, and more particularly to the interests of the city of Montreal, that the deepening of an adequate channel through lake St. Peter should be accomplished with the least possible delay.

That your memorialists perceive with regret and alarm that, since the rising of the House of Assembly in June last, the works in lake St. Peter have been entirely suspended and that the sum of ten thousand pounds, which was voted by the legislature for prosecuting those works, remains unapplied.

That your memorialists conceive it to be their duty, under such circumstances, to point out the loss and injury to trade arising

out of this infortunate delay, and more particularly the hazards to which it exposes the interests of the province at the present critical period. Your memorialists need hardly remind your Excellency that, in the short space of two years and a half from the present time, this colony will be deprived of all protection in the market of England, and left to depend, in a great measure, on her own energies and exertions, so that, unless every advantage is taken by the colonists themselves in improving and extending the navigable resources of the province and economising in every possible way in the conveyance and transportation of the produce of the country, that important traffic must desert the St. Lawrence, and the most serious results to the commerce of the colony and the interests of the city must inevitably ensue. Your memorialists would respectfully remind your Excellency that the deepening of lake St. Peter is one of the most important of the improvements referred to, as, on the completion of that work many of the other improvements now in progress, or in contemplation, will depend for their efficiency or their success, in proof of which, they would point to those now going forward in the upper navigation of the province, the full benefit of which cannot be reaped without an adequate depth of water in the channel of Lake St. Peter.

That your memorialists, in conclusion, cannot refrain from respectfully expressing to your Excellency the serious apprehensions they must continue to entertain respecting the trade and commerce of Montreal, under the approaching changes, unless all public improvements are pushed forward with a zeal and energy commensurate to the emergency; as upon this must mainly depend whether this colony is to succeed in retaining the carrying trade by the St. Lawrence, or whether that trade is to abandon the St. Lawrence for other and more advantageous channels.

May it therefore please your Excellency to take the prayer of this memorial into immediate and serious consideration and adopt such measures in the premises as to your wisdom may seem fit. And your memorialists will ever pray.

(Signed,) GEORGE MOFFATT,
President, Montreal Board of Trade.

(Countersigned,) FREDERICK A. WILSON,
Secretary.

To the above memorial, we are informed, his Excellency made, in substance, the following reply :—

That the government fully appreciate the importance of the work in lake St. Peter.

That after the House of Assembly made an appropriation for the prosecution of those works, the government,—on whom was thrown the onus of deciding which channel should be completed,—lost no time in applying to the British Government to send out a competent person to furnish such information as would enable them to come to a final decision.

That by a recent despatch, the government were informed that Captain Bayfield had been ordered forthwith to repair to Canada to undertake that service; and, that, so soon as his report was received the government would lose no time in prosecuting the works, the importance of which to the province at large and to this city in particular they were fully alive to.

Captain Bayfield's services being obtained, he was employed to make a report on the two channels in the lake and to recommend in which of the two any further attempts at improvement should be made. In the following report he hesitatingly recommends that the work be continued in the new or straight channel. Action was taken on his advice and orders issued for the continuance of the work, as given in the extract of the report of the Executive Council and the letter of Secretary Daly, which follow Captain Bayfield's report :—

*Report of Captain Bayfield, R.N., on the Channels through
Lake St. Peter.*

“GULNARE,” LAKE ST. PETER,

17th September, 1846.

MY LORD,

Having received the commands of my Lords Commissioners of the Admiralty to place myself at the disposal of the Governor-General of Canada, for the purpose of making an examination of

Lake St. Peter with a view of ascertaining in which of the two channels it would be advisable to continue the excavations, and having in the interview with which I was honored, on the 9th instant, learnt Your Excellency's wishes on the subject, I immediately placed myself in communication with the Hon. W. B. Robinson, Chief Commissioner of Public Works, by whom a steamer was placed at my disposal and every information afforded which his office contained. At his office I also met with the Hon. H. H. Killaly, who readily entered into any explanation desired, and who, together with the superintendent of the works, seemed anxious to court investigation.

The conflicting statements and opinions contained in the documents submitted to me at once convinced me that nothing short of a full personal examination of the lake, such as should enable me to form an independent and unbiassed judgment, could afford me any chance of performing the important duty entrusted to me in a manner satisfactory to Your Excellency or useful to the province. Accordingly on the 10th, 11th, 12th and part of the 14th instant both channels were accurately sounded by me and my principal assistant, Captain Orlebar, R.N., in the steamer *Vulcan* and boats of the *Gulnare*, every precaution being taken to ascertain the actual and relative depths by sounding in both channels on the same day, and also by having a tide-pole regularly registered every hour, that no change of level in the lake during our operations should escape notice. The amount of excavation already performed in the new channel was closely examined, the direction and rate of the current at various points was ascertained, and, lastly, the soundings thus obtained, the light-vessels and the buoys of the new channel were all laid down by angles taken by myself and Captain Orlebar on the original chart of the lake, a copy of which accompanies this report.

The following facts were established by our examination:—

1st. That no perceptible change in the relative depths in the present and proposed channel has taken place in the last sixteen years, or since our survey in 1830, excepting at the head of the new channel, where a considerable portion of the shallow bank which formerly existed has been cut away by the action of the current, as shewn by a red dotted line in the chart.

2nd. That there is, (with the exception of one or two places of small extent where the depth is the same as by the present route), from one to two feet more water in the line of the proposed new channel from the fifth buoy down to the point B, than there is on the line of the old or present channel from the lower light-vessel to the same point; thence it follows that if those places of small extent were deepened, and the cut through the St. Francis Bank from the first to the fifth buoy (two miles) completed, an increase of one foot more water would at once be gained.

3rd. The excavation already performed in the new channel fully equals the amount stated in the report of the President of the late Board of Works and shown on the plan of the soundings taken by Messrs. Keefer and Vaughan. If there be any difference, it consists in an increase rather than a decrease of depth since that plan was made. The state of the 150-foot cut is precisely that which is stated by Mr. Killaly; it is, for the most part, of the full breadth of 150 feet and of the required depth, namely, fourteen feet, when there are eleven feet over the flats below the lower light-vessel; in some places it is much wider and deeper; in one or two places only of less width, and of less depth only on angles and ridges left by the dredging, and which it is said were intended to be levelled by the rake.

4th. Although the first cut of 150 feet is thus incomplete, and has not been carried much below the sixth buoy, a current of considerable strength has already been established in it, fully equalling, if not rather exceeding in rate, that which obtains in corresponding parts of the old channel; for instance, at the second buoy of the new channel, the rate was $1\frac{1}{2}$ knots, whilst at the upper light vessel it was $1\frac{1}{4}$ knots. At the seventh buoy $\frac{3}{4}$ knots, and at the lower light vessel $\frac{1}{2}$ a knot. These facts show that there is no tendency in the new channel to fill up, but the contrary; as might be expected, when we consider what would necessarily be the unimpeded direction of the main streams of the river, which unite a short distance below Stone Island, the resolution of the forces of those streams must evidently be in the direction of the new channel, as is clearly proved, not only by the stream established there, but also by the strong current setting to the southward, past the point of the marshes that extend down

from Monk Island, and lastly by the action of the current in cutting away the bank between the red dotted line and the first buoy, as already stated. This southerly inclination of the current is very important, as bearing on the question under consideration, and it appears to have been one of the principal inducements to the selection of the line which has been adopted for the experiment determined on by the Legislature.

The object aimed at appears not only to have been the formation of a deeper channel, by which ships of larger draught of water might pass the lake and ascend to Montreal, but also *ultimately* to effect a great improvement in the navigation by the substitution of a straight channel sufficient for every purpose, instead of the present inconveniently crooked one. Now, if this latter object is to have any weight it will go far to prove, *setting aside pecuniary considerations*, that the selection of the new instead of the old channel has been dictated by enlightened views; and, I may add, that thus far the work has been ably executed.

The *immediate* formation, however, of such a channel as I have contemplated would require the cut through the St. Francis Bank to be made, at least, 100 fathoms wider than has been intended, and an additional expenditure of probably £80,000 or £90,000, unless great assistance were rendered by the current during the progress of the work. The expense would be great, but the result, I am confident, would be the formation of a noble and safe channel, easily buoyed and lighted, through which the main body of the river waters would flow, and might reasonably be expected to widen it still further.

The cost of so great a work is far beyond the appropriation made by the Legislature, and such as it may be deemed imprudent to incur at present, but it is, nevertheless, a consideration of importance that the retention of this new channel would keep in view the possible and ultimate attainment of so desirable an object by the gradual action of the current proved to be going on at its head, and by a limited amount of labor which it might be thought expedient annually to devote to it. Whether this or any other advantages possessed by the proposed new channel afford a compensation for the greater expense of deepening it, I next proceed to consider.

In order to estimate the expense it was first necessary to com-

pute the amount of excavation that would be required to form a channel 300 feet wide and 14 feet deep in the *ordinary* low state of the water in summer, that is when there is 11 feet of water over the flats below the lower light vessel. This has been done as follows:—

To deepen the old or present channel from the point C. just above the lower light vessel to the point B. in 14 feet water.

See Chart.	Distance. Yards.	To deepen. Feet.	To remove. Cubic Yards
From C to A	1,500	..... 2	..... 100,000
A to B	2,300	..... 3	..... 230,000
B to C	3,200	..... 2½	..... 266,667
C to D	900	..... 2	..... 60,000
D to B	2,180	..... 1	..... 71,667
<hr/>			
Total distance { or 5 nautic miles less 55 yards }	10,080	Total,	729,334*

* Exclusive of the small bar above the upper light vessel, which may be estimated at from 10,000 to 15,000 cubic yards.

To deepen the new or proposed channel:—

	Distance.	To remove.
To complete the first 150 feet from the first to the fifth buoy	4,000	69,245
To complete the second 150 feet from the first to the fifth buoy		189,648
		<hr/>
Total to be removed in the 300 feet channel through the bank of St. Francis		258,893

This is taken from the plan of the soundings by Messrs. Keefer and Vaughan, verified by Captain Bayfield, and is, if anything, an over-estimate.

	Distance. Yards.	To deepen Feet.	To remove.	
From the 5th to 7th buoy	3,200	.... 1½	.... 160,000	
7th to 10th "	5,050	.... 2½	.... 378,750	
10th to * in chart	2,200	.... 2	.... 146,667	
* to B.	2,750	.... ½	.... 45,833	
				<hr/>
Distance from 5th buoy to B.	13,200	6½ nautic miles		731,250
" 1st to 5th buoy	4,000	2	"	
				<hr/>
Total " 1st buoy to B.	17,200	8½	"	Total, 990,143

Now assuming the cost of removing a cubic yard to be one shilling and three pence currency, which is one penny more than the estimate of Mr. Killaly, the expense will be as follows:—

For the old or present channel—

From D to C., 729,334 cubic yards,	£45,583	7	6	} Requiring 3 seasons' work at 245,000 cubic yds. per season
Add for small bar above upper light vessel,	1,000	0	0	
Total,	£46,583	7	6	

For the new channel—

From the 1st buoy to B,				} Requiring four seasons work.
990,143 cubic yards,	£61,883	18	9	
Difference,	£15,300	11	3	

This difference, however, in favor of deepening the old channel would have to be considerably diminished if it should be decided now to abandon what has been done in the new one; for the expense of removing the buoys and replacing them on a new line, and stopping up the cut already made through and below the St. Francis Bank, would probably cost several thousand pounds. It would be unsafe to leave the new channel open, because the very considerable quantity of water now passing through it would lessen the chance of any cut that might be made through the flats of the old channel remaining open.

The expense of such works almost invariably exceeds the estimate; but in this case, if the expense of the establishment for deepening Lake St. Peter be, as stated in the report of the President of the late Board of Works, only £8,500 per annum; and also that from improvements in the machinery and increased experience, much more than 245,000 cubic yards can be removed in a season, then the expense will be considerably less than I have estimated. Assuming, however, the difference of expense against the new channel, without any reduction, to be about £15,000, I next proceed to consider whether there are not counterbalancing advantages in retaining it, considering it as an *additional* channel for the special purpose of enabling ships of larger draught to pass the lake, the present channel being sufficient for all other purposes.

A channel 300 feet wide is not sufficient for any other than the purpose I have named; that breadth is sufficient for steamers either with or without vessels in tow, to run along a straight and continuous line of buoys a quarter of a mile apart, and to pass each other with common care in the day time; and this seems all that can be required for the purpose in view, for it is only in fine and clear weather, and when the water is high, that it is ever attempted to take ships of heavy draught through the lake at night, the few hour's delay that might occasionally occur from waiting for daylight, could never be of much consequence. Regarding, then, the channel in this light, all the objections on account of its narrowness fall to the ground, and here I may remark that the facility with which the steamer *Vulcan* was steered along the line of buoys was such as to convince me that if the present cut of only 150 feet in width had been completed, all the ships at that time aground in the lake might have been brought up it simply and with care, although so narrow a channel would be altogether insufficient under ordinary circumstances. The advantages of the proposed new channel then are, that it is straight throughout; that from the natural direction of the main stream of the current through, and its action already proved to exist, there is strong reason to expect that the channel, if once completely formed, would, with very little assistance, continue to widen at its head, and for the first two miles, down from the first to the fifth buoy, where it passes through the Bank of St. Francis, and where alone its margins are very shallow; in the remaining $6\frac{1}{2}$ miles it would have the advantage of having never less, and in general from one to two feet more water adjacent to it, than there would be on either side of a cut through the flat below the lower light vessel. It is only in the direction of the new channel that any ultimate improvement in the navigation, for *general purposes*, can be reasonably expected.

Now to set off against this, we have, in the old channel, the sole but important advantage of its breadth, down so low as the lower light vessel; an advantage so great that, if the intention were to make a channel for all purposes it could only be compensated by cutting through the bank of St. Francis, a channel at least 100 fathoms wider than has been intended, as I have before remarked.

The objections to the old channel are its crookedness. In the

thick fogs that so frequently prevail on the lake it is extremely difficult to know when to take the turns, or even to find the lower light vessel, at times, when ascending over the flats. Another objection is the less probability, as compared with the new channel, of any attempt to deepen it being permanent, on account of the weakness of the current from the lower light vessel down to B, which it appears impossible to strengthen by directing any additional streams into it, and which the southerly inclination of the waters described in a previous part of this report seems to threaten with a still further diminution.

Before I attempt, in conclusion, the somewhat difficult task of balancing these conflicting advantages and disadvantages with the view of giving the opinion required of me, I beg to observe that the question is no longer the same as before the commencement of the works, since a large sum has been expended, and considerable progress made in forming the new channel, and considerable experience gained as to the set of the current, &c.

If, on the first instance, when I was consulted before the commencement of the works, it had been represented to me that the amount of excavation required to deepen the new channel, and consequently the expense, would be nearly double of that required in the old channel—instead of its having been inconsiderately stated to me by an authority, the competency of which I could not doubt, that on a comparison of the two channels it was found that the quantity to be removed in the straight channel was “but little more than what would be necessary in the crooked one,” I might have doubted whether any advantage possessed by the new channel could have afforded a sufficient compensation for so great a difference of expense in the present burthened state of the colonial revenue, and compelled to decide in favor of the attempt being made in the line of the old channel. But now, under the present altered circumstances of the case, and considering that £29,200, (or according to Mr. Killaly £23,000), has been already expended on this work, and very considerable progress made in it, that the experience gained as to the set and strength of the current toward and through the new channel affords a very strong probability not only of its keeping open, but also of its becoming considerably wider, and thus affecting eventually a great improvement in the navigation which could not be looked for in deepen-

ing the old and crooked channel, considering also the advantage of having in the meanwhile an *additional* straight channel for heavy ships, with its numerous and heavy iron buoys out of the way of the small craft and swift passage steamers running in dark nights; also the necessity, the difficulty and the expense of closing the new channel again, now that it is so far made; and lastly the small difference, considering the magnitude of the work, in the expense of completing this new channel over what would be required if it were to be abandoned for the old one: I arrive at the conclusion, not, however, I confess, without much hesitation, that it would be inexpedient now to sacrifice the sum already expended, for another route, which however great may have been its advantages in the first instance, in point of economy, is destitute of those prospective advantages of the new channel, which may be considered a compensation for the small difference of expense which has been stated.

I therefore respectfully submit to your Excellency, as my opinion, that the new channel should be completed of the regular depth, namely, 14 feet in the ordinary low water of summer, and 300 feet wide; that breadth being considered sufficient for the special and principal purposes of enabling ships of heavy draught, in tow of steamers, to pass through the lake. For this purpose, the present line of excellent buoys should be kept complete, but until it becomes or is made wider, it will not be necessary to incur the expense of lighting it, since its use by night is not contemplated whilst the present ship channel remains sufficient for the general purposes of the trade. Steamers may use it with advantage by day, saving a mile of distance, but rafts should be forbidden to use it, lest they should injure the buoys, or get in the way of vessels.

I have, &c.,

(Signed,)

HENRY W. BAYFIELD,

* Captain R. A.,

Surveying the Gulf of St. Lawrence.

The Right Honorable

EARL OF CATHCART, K.C.B.,

Governor-General, &c., &c.

Extract from a Report of the Honorable the Executive Council, dated 21st September, 1846, approved by His Excellency, the Governor General in Council, on the same day.

On the Report of Captain Bayfield, dated 17th September, 1846, of his examining of Lake St. Peter, with a view of ascertaining in which of the two Channels it would be advisable to continue the excavations.

It appears clear to the committee that, in the present state of the question, Captain Bayfield thinks the new channel should be proceeded with in preference to commencing any improvement of the old. It must be borne in mind, however, that Capt. Bayfield is of opinion that the new channel should be 300 feet wide, while the committee understand it has at present been only made 150 feet, and that, on this scale, an expenditure of £60,000 will be requisite in order to complete a new channel of 14 feet deep. From a careful consideration of the whole case, the committee think that the report of Captain Bayfield sufficiently establishes the propriety of persevering with the new channel, in preference to commencing an expenditure on the old. They are not prepared, however, to recommend the application to Parliament for so large an additional sum, or to advise that anything should be undertaken at present which will exceed in cost the the appropriation made last session. They, therefore, respectfully advise that the work be continued on the former scale of 150 feet wide along and over the flats, toward the point B, as designated on the chart furnished by Captain Bayfield. For this purpose, they understand the appropriation already made is sufficient. They conceive that this will make the channel available to the trade, although to a limited extent; that the action of the current as explained by Captain Bayfield will be continually widening and deepening the channel so formed and thus slowly diminishing the expense of its completion, to the width recommended by Captain Bayfield, whenever the financial state of the Province shall warrant an additional appropriation.

Certified.

(Signed,)

E. PARENT.

(Copy).

SECRETARY'S OFFICE,

MONTREAL, 22nd Sept., 1846.

SIR,

I have the honor, by command of the Governor-General, to acquaint you that His Excellency in Council has had under consideration the report of Captain Bayfield, dated 17th instant, of his examination of Lake St. Peter, with a view of ascertaining in which of the two channels it would be advisable to continue the excavation, and that, on a careful perusal of the report, His Excellency in Council has determined to continue the work, on the straight channel on the former scale of 150 feet wide, along and over the flats towards the point B, as designated on the chart furnished by Captain Bayfield, which I transmit for your information, and which I am to request you will return to me after having made a copy of it, if you deem it advisable.

His Excellency in Council understands the appropriation already made is sufficient for the above purpose, and will make the channel available to the trade, although to a limited extent.

His Excellency is further given to understand that the action of the current, as explained by Captain Bayfield, will be continually widening and deepening the channel so formed, and will thus slowly diminish the expense of its completion in the width of 300 feet which Captain Bayfield recommends when the financial state of the province shall warrant it, but the expense of which His Excellency is not prepared to recommend to the Legislature at present.

I am therefore to request, that you will be pleased to take the necessary steps for carrying this decision of His Excellency in Council into effect without delay.

I have, etc.,

(Signed,)

D. DALY,

Secretary.

The Honorable

WM. B. ROBINSON,

&c., &c., &c.

Extracts from "QUEBEC GAZETTE," 1846.

"Montreal, Sept. 19th.—H. M. S. "Gulnare," Captain Bayfield, arrived here from lake St. Peter yesterday. We do not know whether Captain Bayfield's report will be promulgated immediately or not, but we think it ought to be, as the channel through lake St. Peter is a matter of great interest to the people of Montreal."

"Montreal, Sept. 23rd.—Lake St. Peter.—We have been informed that Captain Bayfield's report recommends the completion of the new channel and that the works are to be immediately resumed."

"Montreal, Sept. 24th.—Lake St. Peter.—We are delighted at being able to announce to our readers that orders have been issued from the Department of Public Works immediately to resume the works in lake St. Peter, and proceed to complete the new and straight channel. Captain Bayfield has reported decidedly in favour of this channel, thereby proving the Board of Works to have taken a right view of the matter. We understand that it is not the intention of the government to publish Captain Bayfield's report until it is submitted to Parliament."

Extract from "THE PILOT."

September 26th, 1846.

We copy from the *Gazette* the following demi-official announcement of the determination of the Government regarding the works at Lake St. Peter:—

"We mentioned in our last that Captain Bayfield's report on Lake St. Peter was laid before His Excellency on Saturday. It was generally known in the city yesterday that the Government had issued orders for the immediate resumption of the excavation of the straight channel, which was suspended in consequence of the report of the committee of the House of Assembly. The purport of the report may, therefore, be guessed. It is not probable that it will be published until Parliament meets, when ministers

will rest their justification on it. We have heard little of its contents, but, we believe, we are correct in stating that, though Captain Bayfield expresses a doubt, or something more than a doubt, whether, had correct data been laid before him, he could have originally advised the commencement of the new channel, still, examining the state of the currents, finding that the current through it is more rapid than that through the old channel, and that, in consequence, to give the latter fair play, the new one ought to be blocked up; looking at the advanced state of the work, he thinks that, on the whole balance of considerations, it is expedient to complete the channel already begun, and this accordingly the Government has decided to do with all practicable expedition."

We learn from the above that the report will not be published until the meeting of Parliament. The *Gazette* declares, "we have heard little of its contents, but we believe we are correct in stating, etc." Now, according to our notions of justice, either the whole report should have been published, or else *none of its contents* should have been communicated to our demi-official contemporary for public use. It is to be recollected that for many months back Mr. Killaly's professional character has been attacked in all quarters with regard to this work. The Government applied to the Admiralty to select a competent officer, to report on the work, and his report has been received. We presume, from the *Gazette's* article, that no copy of the report has been furnished to Mr. Killaly. If this be the case, we can only say that we believe such conduct is as unprecedented as it is manifestly unjust. What possible object can there be in withholding this report?

The Government has determined on its policy; it has ordered the work to be continued, and it announces demi-officially that it "will rest its justification" in Captain Bayfield's report. What then is the motive for concealment? Will the report not bear criticism? Are ministers afraid that its errors will be exposed, if it be submitted to public inspection? This would certainly be the natural inference. But however objectionable it might have been to conceal the report altogether, the course taken by the *Gazette* is wholly unwarrantable. In a demi-official article it alludes to a report said to be confidential, and which at all events

is withheld from the public, and insinuates that it condemns Mr. Killaly's proceedings. There is a degree of malignity in such a course which leaves no doubt in our mind that the article was instigated by some individual connected with the present Board of Works, and with the palpable object of injuring Mr. Killaly. For our own part we have abstained from all interference with this dispute.

We find that great difference of opinion prevails in the community, and our great uneasiness has been lest the result of the quarrel should be the abandonment of the whole work, which is just what we think Mr. Robinson would like. We desire to maintain our position of neutrality, but we are anxious that Mr. Killaly should have fair play. He had a right to expect the publication of Captain Bayfield's report as soon as the Government had come to a decision on the question, but most assuredly after the *Gazette's* demi-official statement it would be a monstrous act of injustice to conceal it any longer ; it would, however, be quite in accordance with the spirit which presides over the Government, and especially over the Board of Works.

But although work had been resumed in the fall of 1846, opposition to the straight channel had not ceased to exist, as appears by the following extracts from the Journals of the Legislative Assembly for July, 1847, which give the report of the select committee appointed to consider the return to an address containing Captain Bayfield's report :—

Extracts from the Journal of the Legislative Assembly.

5TH JULY, 1847.

Resolved,—That the return to an address, laid before the House on the second instant, containing the report of Captain Bayfield, R.N., and other documents, on the improvement of the navigation on lake St. Peter, be referred to a select committee composed of Messrs. Williams, Petrée, Armstrong, Stewart of Bytown, and Merritt, to report thereon with all convenient speed, with power to send for persons, papers, and records.

13TH JULY, 1847.

Mr. Williams from the select committee, to which was referred the return to an address, laid before the House on the second instant, containing the report of Captain Bayfield, R.N., and other documents on the improvement of the navigation on lake St. Peter, presented to the House, the report of the said committee, which was again read at the clerk's table; and is as followeth:—

Your committee, having attentively and considerably examined the voluminous and important documents submitted to them by your Honorable House, beg leave to make the following report, as the result of their investigations on this momentous and hitherto controvertible question.

Your committee have evidence, that the cut through the St. Francis bank, to make an artificial channel through lake St. Peter, was undertaken and proceeded with on erroneous data of the contemplated expenditure, and seriously at variance with what might have reasonably been anticipated, and in contravention of the enactment of 4 & 5 Vic. c. 58, sec. 15; and on this subject, Capt. Bayfield, in his report of 17th September last, makes the following observations:—"If, in the first instance, when I was consulted before the commencement of the works, it had been represented to me that the amount of excavation required to deepen the new channel, and consequently the expense, would be nearly double of that required in the old channel, instead of its having been inconsiderately stated to me by an authority, the competency of which I could not doubt, that on the comparison of the two channels it was found that the quantity to be removed in the straight channel was but a little more than what would be necessary in the crooked one, I might have doubted whether any advantages possessed by the new channel could have afforded a sufficient compensation for so great a difference of expense, in the present burdened state of the Colonial Revenue, and been compelled to decide in favor of the attempt being made on the line of the old channel."

Your committee are disposed generally to coincide with Capt. Bayfield in his last report, in reference to the following particulars:—

That if the artificial channel be completed to the full extent contemplated by the late Board of Works, it will not be available for the general purposes of trade, that neither steamboat nor vessels can navigate the said channel at night.

That steamboats, with vessels in tow, may navigate the same in day time, but sailing vessels, with a large draught of water, cannot proceed in this channel without being in tow of a steamer, even in the day time, that rafts must not be permitted to pass down the lake by this channel, to interrupt the navigation. Capt. Bayfield also states that to render this channel available for general purposes, the cut through the St. Francis bank must be at least 100 fathoms wider than has been contemplated, and that to accomplish the same, the cost will be at least £80,000 or £90,000 more than has been appropriated.

Your committee, however, in reference to the estimated cost of a channel, are decidedly of the opinion that the sum of £400,000 will be inadequate to secure its ultimate completion; an expenditure which your committee conceive would be unjustifiable, when they take into consideration that, on the completion of the St. Lawrence canals, vessels will proceed from the ports on the upper lakes, with their cargoes, direct to Quebec without transshipment; and even if completed to the breadth of 900 feet and 14 in depth, as recommended by Capt. Bayfield, at the costs above enumerated, that portion of the old natural ship channel which has a breadth from 1200 to 1500 feet, and a depth of 18 to 20 feet, for a distance of $4\frac{1}{2}$ miles down to the lower light vessel, would at all times be more advantageous to vessel of all classes both by day and night.

Your committee agree with Capt. Bayfield that the current in both channels is nearly the same, and coincide with him in opinion that it is no use to light up the new channel when completed; and also that the new channel should be left open, considering it an additional channel although to a very limited extent, for the special purpose of ships of large draught in the tow of steamers in the day time.

Your committee, however, cannot agree with Captain Bayfield, that the gradual action of the current in the new channel will annually improve its capabilities, but are more disposed to acquiesce, though with considerable limitation, in the evidence

given by Captain Bayfield in reference to the improvement of the navigation of Lake St. Peter before a Select Committee of the House of Assembly of Lower Canada, on the 16th Jan., 1836, and reported in Appendix to vol. 45, viz.: "It is not impossible that the end first excavated might be filled up by sand washing into it, by the time the other end was reached;" and further, in the same evidence, in reference to the width of the contemplated cut through the bank of the St. Francis, Captain Bayfield purposes to limit the width of the excavation to 200 feet, "and it could not well be less," says he, "to allow vessels to turn in and pass each other without risk." In his recent report, however, he appears to have recommended a channel of 900 feet in width, which your committee conceive more adequate in magnitude for the purpose contemplated.

Your committee are, however, conscious that a channel of this magnitude would involve an expenditure of at least £400,000, a sum of £70,000 having already been expended in excavating a channel of fifty yards in width, and there yet remains for excavation, to complete this channel of fifty yards, no less than 374,871 cubic yards, involving an additional expenditure of £28,500.

Your committee find appended to Captain Bayfield's report a Report of the Committee of the Honorable Executive Council, dated 21st September, 1846, approved of by His Excellency the Governor-General the same day, ordering that nothing should be undertaken at present that should exceed the cost of the appropriation of last session. Your Committee trust that this wise determination will be persevered in, inasmuch as the advantages to be attained by a large outlay in this channel will not be, as your Committee conceive, commensurate with any increased expenditure.

With reference to the Report of a Committee of Inquiry held at Sorel in relation to certain charges made against the Superintendent of the works on Lake St. Peter, your committee cannot but express their approbation of the promptitude and impartiality evinced in this investigation, and the judicious and satisfactory decision had thereon.

Ordered,—That the Report of the Select Committee to which was referred the inquiry relating to the Lake St. Peter be printed for the use of the members of this House.

JULY 22ND, 1847.

On motion of Mr. Williams, seconded by Mr. Petrée,

Resolved,—That this House doth concur in the report of the Select Committee to which was referred the return to an address laid before this House on the 2nd inst., containing the report of Captain Bayfield, R. N., and other documents on the improvement of the navigation on the Lake St. Peter.

The work was still in progress when the report of the Commissioners of Public Works was laid before the Legislative Assembly in, July, 1847. Extracts from this report here follow. From these it appears that after the suspension of the work in June, 1846, the management was changed, and the execution of the work transferred from the Board of Works to the control of the Commissioners of Public Works.

Extract from the Report of the Commissioners of Public Works, laid before the Legislative Assembly 12th July, 1847.

LAKE ST. PETER.

This work has been in progress since 1844, but had been suspended in June last before the Commissioners assumed the management of the Public Works. This was done for the purpose of ascertaining Captain Bayfield's views respecting the best course to be pursued in the then state of the work. Captain Bayfield examined the new as well as the old channel very carefully, and made his report in September to the Executive Government. Orders were then given to continue the dredging in the channel, adopted by the late Board of Works, which was done to the end of the season, 1846. During the winter, the dredges and scows were thoroughly repaired and the work commenced on the 17th May, upon the St. Francis bank, this being the only place where

the water was then low enough to admit of the dredges working to any advantage. The Commissioners hope to finish the channel of 150 feet next summer. The average depth of dredging, from the sixth buoy to the lower end of the cut is two feet, but it is evident much requires to be done above the sixth buoy, the channel not being of the full width of 150 feet, as supposed, throughout. A statement is annexed, (Appendix Letter K), shewing the total expenditure up to this period and as accurate an estimate as can at present be made of the amount required to complete it throughout, on the scale commenced by the late Board of Works, viz.: 150 feet wide and fourteen feet deep.

Mr. Killaly, in his report to the Legislature dated 2nd April, 1846, states that an additional breadth of 150 feet "can be effected at an additional cost of two years more work, estimated at £17,000, or say £20,000.

The Commissioners would refer to the expenditure up to this time, to shew, that the amount mentioned by Mr. Killaly would not be sufficient, and that it would require nearly double the sum mentioned by him to effect it.

Mr. Rubidge has made it amount to £38,698 10s. 0d. and has based his calculations upon the minute survey, taken in the winter season through the ice, by Mr. Killaly's order.

The exact cost of a work under water cannot be ascertained, but it is evident £20,000 would be quite inadequate to increase the Channel to 300 feet.

K.

Report of F. P. Rubidge on Channel thro' lake St. Peter.

PUBLIC WORKS OFFICE,
31st MAY, 1847.

GENTLEMEN,

On a careful revision of the Report upon lake St. Peter improvements which I had the honor to lay before you on the 23rd March last, and having obtained further data whereon to

found my calculations, I now beg respectfully to submit a corrected statement of the amount of dredging operations up to the present time, from the period of commencement, in 1844, shewing the total outlay thereon, and the extent of excavation yet to be performed to complete a Channel of 150 feet in width, and also one 300 feet broad, being therein detailed, from which it will appear that 520,963 cubic yards of clay and sand have been removed at the assumed rate, slightly exceeding 1s. 5½ per cubic yard and at a cost of..... £38,267 7 0

And estimating the whole working establishment of steamboats, dredges, scows, barges, machinery, moorings, buoys, anchors, implements, &c., &c., at the reduced value of 20 per cent..... £31,606 9 3

We obtain the sum expended, of £69,873 16 4

The bulk of heavy excavation removed as above being about 750,000 tons.

Having, at your desire, very recently visited lake St. Peter, or a few days after mooring the dredging vessels for their Spring operations, I am enabled more intimately to describe the nature of the shoals whereon the improvements are being made. The lateness of the season and high floods, had hitherto prevented the works proceeding with much expedition at the period of my visit; the level of the lake, standing ten feet over ordinary low water, hindered the machinery from working to the best advantage, except in reducing the ridges and isolated spots left from former operations on the St. Francis Bank near the second and third buoys, upon which ridges there were at that time from 17 to 20 feet in depth of water. Upon this bank the dredges have to cut thro' a firmly compacted bed of fine sand, about 3 to 4 feet in thickness, with occasional thin strata beneath of similar character; this material is severely trying to the dredges, frequently breaking the mooring cables, the pins securing the links of the bucket chains, and otherwise deranging the machinery in passing thro' it.

Beneath the excavation becomes a soft tenacious clay, that hardens readily on exposure to the atmosphere, thro' this yield-

ing substratum the buckets move with facility, frequently lifting to the surface more stuff than their interior limits will contain, and the quantity of this material taken up in one day by the dredges generally doubles the bulk removed from the first described consolidated bed of sand.

The lower flats below the sixth buoy consist wholly of this soft blue clay bottom, and the fact that the chief portion of the work yet to be accomplished will be in this facile excavation, argues favorably for the future expedition and expense attending the deepening of this Channel.

The dredging up to the 31st of May of the present year, gives the additional quantity of 13,008 cubic yards removed, but this amount has not been noticed or deducted from the tabular statement, owing to the disbursements for the month of May not having been defrayed up to the present time from the balance of money on hand. From the sixth buoy onwards to about midway between the eleventh and twelfth buoys, I have taken the average depth of water at twelve feet, thus giving two feet of general excavation, (calculations of former years have, I perceive, assumed the average depth for this distance to be thirteen feet, affording only one foot of general excavation and yielding less formidable results); but on a more thorough examination, this must be held too low an estimate, as appears evident from the following extract from a report of Captain Vaughan, the late Superintendent, dated 8th February last, wherein he states "there will be three feet of cutting of soft blue clay from No. 7 to No. 12 buoys," etc., etc. This labor alone would require 440,000 cubic yards of excavation, and, at the lesser rate of 1s. 3d. per cubic yard, would amount to £27,500. On mature deliberation, therefore, in taking the mean between the above extremes, of two feet depth of cutting, (which Captain Bayfield's soundings of last year will I think fully support), I have drawn up the accompanying statements previously referred to. I beg to direct your attention in the next place to the amount of dredging thus arrived at, as requisite to complete a Channel 150 feet broad. See statement No. 3, namely 374,508 cubic yards, which, at the rate say 1s. 5d., throwing off the fraction, would demand a further sum of £26,527 11s. 7d. and at the speed at which the work has hitherto progressed, would occupy the present season and the whole summer

of 1847 before completion. For this additional outlay, a balance of £4,619 8s. 2d. from former appropriations, yet remains available.

Statements No. 2 and No. 3 also indicate the extent of excavation to be removed for the additional Channel of 150 feet in width, having 14 feet depth at low water, therein stated at 619,176 cubic yards, and estimated at £38,698 10s. currency. These united quantities and outlays, to perfect an ample and sufficient Channel of 300 feet wide, giving an aggregate of 993,683 cubic yards and a total cost of £65,226 1s. 7d. and to perform the entire task with the present equipment and force employed, requiring a period of four years beyond the present season.

On comparing the quantities detailed in sheet No. 2, yet to be removed for an additional 150 feet width of channel, with the quantities given as already removed, between the first and second buoys, the smallness of the former opposed to the bulk of the latter becomes apparent. This difference arises from the fact of deeper water being found on the St. Francis Bank to the south of the channel first dredged, where holes either exist or the current has succeeded in working out a partial channel, as is shewn by the recent chart of Captain Bayfield, and further corroborated by the chart of soundings in the office of this department, and also from the dredges having occasionally operated too much to the southward. The number of cubic yards, however, to be lifted from the south or additional channel, between the first and second buoys, stated as 50,014, would give an average of about three feet five inches depth of general excavation.

I would here observe that the basis for the foregoing calculations were soundings taken through the ice, (not, however, made by myself, but which, nevertheless, I believe sufficiently correct), and likewise the annual log-books of the department.

It is not the object of this report to draw comparisons between the relative merits of the rival channels, but I would observe that, on a calm day, a considerable current is perceptible in the new channel, the more remarkable as occurring in a lake seven miles in width, where it might be supposed all sensible current would be lost in the expanded waters. With reference also to the assertion that this channel or cut is "filling up," I cannot say, from my own observations, that I am of that opinion. The last summer, on a favorable occasion for sounding, I found the ridges

sharp and distinct with two and three feet deeper water on either side. If this "filling" therefore had been going on, these obstructions would naturally have caught the moving sand, and either become less prominent or have been buried in the accumulating drift. Moreover, on the dredges working on the shoalest spots during high water of this spring, the lighter color of the surface-excavation in which rushes were growing abundantly, evidently shows the bottom free from deposit and heretofore undisturbed. I would further mention that on the 20th of August, last year, on a perfectly calm day, the *Vesper* brig, of 290 tons burthen, in tow of the *Princess Charlotte*, grounded a little below the lower light-vessel in the old ship channel while drawing 10 feet 6 inches, water. The soundings which I took at the time, at the stem of the brig, giving only 10 feet 2 inches water, and on immediately proceeding to the new channel, the flats, in no place, gave a less depth than 11 feet, clearly proving, I think, a slight advantage in depth on the flats, to the south of the present ship channel. And here, again, on these flats, in the line of the straight channel, one description of "filling" might reasonably be looked for, namely, as the dredges disturb the bottom surface they produce a thick muddy stream, which is carried by the current along the narrow cut, until its velocity is checked over the lower flats, where the soil in suspension gradually settles to the bottom. This effect, I take for granted, must be produced to a certain extent.

In connection with deepening Lake St. Peter, for vessels drawing 14 feet at low water, must be taken into consideration the removal of two shoals or flats at Lavaltrie, upon which there is about 11 feet at low water. Not having personally examined these obstructions, my observations are based upon the information of others, from which I gather that they cover about 150 yards in length, and consequently require the removal of 15,000 cubic yards; supposing the channel to be made 300 feet broad with 3 feet average depth of cutting; this excavation being mud with boulder stones interspersed, I have computed the cost per yard at 1s 8d., and which would therefore require a further expenditure of £1,250.

All of which is respectfully submitted.

(Signed,)

F. P. RUBIDGE,
Engineer, Public Works.

The Honorable Commissioners of Public Works, &c., &c., &c.

No. 1.

Statement of the whole operations performed in the new channel of Lake St. Peter, of 150 feet in width, to obtain 14 feet depth at low water ; also showing the cost of excavation per cubic yard, and the present value of the Dredging Establishment to the Province.

The dredging and excavation for the years 1844 and 1845 (as per statement No. 2) amounted in cubic yards to.....	406,111
The dredging and excavation for about three weeks of 1846.....	114,852
	<hr/>
Total lifted in cubic yards,	520,963
The cost of outfit and purchase of steamboats, dredging vessels, scows, barges, chains, anchors, buoys, machinery, tools, implements, and materials, as per return.....	£39,508 1 6
Depreciation for three years service, say 20 per cent	7,901 12 3
	<hr/>
	£31,606 9 3
520,963 cubic yards of excavation at 1s 5½d, nearly, or say.....	38,267 7 0
	<hr/>
Being the whole amount of expenditure up to the 15th May, 1847.....	£69,873 16 3

(Signed,)

F. P. RUBIDGE,
Engineer, Public Works.

No. 2.

Tabular Statement of the amount of Dredging performed in Lake St. Peter, up to the close of the Navigation of the year 1845, with the quantities yet to be removed to give a Channel of 150 feet wide; also of 300 feet in width, with 14 feet depth at low water, verified from soundings taken through the ice in 1846, and from the Log Book of the Superintendent up to that period.

LOCALITY.	Distance.	Quantity removed.	Yet to remove for 150 ft. width.	Yet to remove for an additional 150 feet.	Total to remove for 300 ft. channel.
	Mls.	Cubic yds.	Cubic yds.	Cubic yds.	Cubic yds.
Betw'n 1st & 2nd b'ys.	$\frac{1}{2}$	158,023	17,119	50,014	67,133
" 2nd " 3rd "	$\frac{1}{2}$	141,173	19,090	47,273	66,363
" 3rd " 4th "	$\frac{1}{2}$	72,478	18,256	63,522	81,778
" 4th " 5th "	$\frac{1}{2}$	22,553	14,780	28,514	43,294
" 5th " 6th "	1	11,884	48,446	58,185	106,631
" 6th " 7th "	1	* }	67,576 †	67,576	135,152
" 7th " 8th "	1		67,576	67,576	135,152
" 8th " 9th "	1		67,576	67,576	135,152
" 9th " 10th "	1		67,576	67,576	135,152
" 10th " 11th "	1		67,576	67,576	135,152
Half-way between 11th and 12th buoys.....	$\frac{1}{2}$	}	33,788	33,788	67,576
	$8\frac{1}{2}$		406,111	489,359	1,108,535
Removed in 1846 .....	.....		114,852	.....	114,852
Total up to 1847, cub. yds. ....	.....		520,963	619,176	993,683

* The average depth of these distances, assumed at 12 feet, giving two feet excavation to obtain 14 feet at low water.

† Note.—150 feet x 2 feet excavation = 300 feet, x 6,082 feet or nautical mile = 1,824,600 = 67,577 cubic yards.

Signed, F. P. RUBIDGE.

No. 3.

Statement of quantities and cost of excavation, yet to be removed, to complete a Channel of 150 feet, and also of 300 feet in breadth, with 14 feet depth at low water.

To remove, as per statement No. 2, 374,507 cubic of excavation for the Channel of 150 feet wide, at, say 1s. 5d., per yard.....	£26,527 11 7
To remove, as per statement No. 2, 619,176 cubic yards of excavation for the additional width of 150 feet (allowing the work to proceed to better advantage) at the reduced rate of 1s. 3d. per yard.....	£38,698 10 0
	<hr/>
	£65,226 1 7
To remove the united quantity of 993,683 cubic yards for a Channel 300 feet wide with 14 depth at low water, would require the gross sum of £65,226 1s. 7d. To meet which there remains a balance available from former ap- propriations unexpended up to the 15th May, 1847, of	£4,619 8 2
	<hr/>
Balance requisite for a 300 feet Channel.....	£60,606 13 5

(Signed,) F. P. RUBIDGE.

EXTRACT FROM (APPENDIX Q. Q.) REPORT OF THE COMMISSIONER OF PUBLIC
WORKS, LAID BEFORE THE LEGISLATIVE ASSEMBLY, 12TH JULY, 1847.

*General Statement of Expenditure on Lake St. Peter, from December, 1841,
to December, 1846.*

	£	s.	d.	£	s.	d.
Surveys	650	2	7			
Plans	76	0	9			
Establishment.....	15,274	10	11			
Contractors,(cost of Steamboats, Scows, &c.)	16,224	18	4			
Postage	86	14	5	32,312	7	0
Freight and Towage	1,483	0	10			
Materials	20,783	3	2			
Advertising	16	6	3			
Professional Services.....	21	5	0			
Firewood	2,195	14	8	24,499	9	11
Travelling Expenses	239	11	11			
Accounts (Iron, Chains, Paints, &c.).....	2,029	18	6			
Examining Accounts, &c. (Clerks' salaries)	102	6	8			
Insurance	161	2	0			
Labor in Ship-yard, &c.....	2,246	13	2	4,779	12	3
Coal	3,862	14	9			
Steamer "Vulcan"	2,500	0	0			
Ship-yard.....	281	5	0			
Investigation	11	10	0	6,655	9	9
				£68,246	18	11
Deduct amount received for materials sold.				113	1	3
				£68,133	17	8

The following extracts from the papers of the day bear on the closing operations in the straight channel. The extract from the *Quebec Mercury* of 12th August, 1847, contains an official letter from Mr. Begley, showing the nature and object of the work done in the fall of 1847, just before the final suspension of the work:—

(Extract from the Quebec Mercury, July 17, 1847.)

It has been determined that no additional grant shall be made for the Lake St. Peter infatuation; we believe that an effort will be attempted to save the Province the remaining £4,000 out of the £74,000 destined to be sunk in the mud of the lake.

(Extract from the Quebec Gazette, July 23, 1847.)

It is to be hoped that the following Report* of a Select Committee of the Legislative Assembly will put an end to the outrageously scandalous job of the Lake St. Peter straight channel. For the loss of the £70,000 already sunk in that channel by the late Board of Works, in violation of positive law and in opposition to the dictates of common sense, the people, out of whose pockets the money came, must console themselves with the reflection that they are in the full enjoyment of "responsible government;" it would be madness on their part to attempt to recover the £70,000 by throwing in after them £400,000 more, which the Committee declare would be inadequate for that purpose.

(Extract from the Quebec Mercury, Aug. 12, 1847.)

The following is a communication from the Department of Public Works to the Board of Trade on the subject of the

* See page 179.

improvement of Lake St. Peter, and we understand the Board are strongly urging the Department not to delay the re-opening of the Lachine Canal longer than the 15th proximo:—

[COPY.]

PUBLIC WORKS,

MONTREAL, 10th August, 1847.

SIR,

In reference to my letter of the 4th inst., respecting the work on Lake St. Peter, I am directed to state, for the information of the Board of Trade, that from an examination and report made last week by order of the Commissioners, by Mr. Rubidge, one of the engineers to this Department, it is deemed advisable to excavate a channel through the Flats to deep water this season, of such width as time and the amount remaining of the appropriation will enable the Department to accomplish. This will test the effect of the current passing through the straight channel in preventing deposit taking place.

I have the honor to be, Sir,

Your obedient servant,

(Signed,)

THOMAS A. BEGLEY,
Secretary.

F. A. Wilson, Esq.,
Secretary Board of Trade.

The work of cutting the straight channel was finally suspended on the 16th of September, 1847. (See Mr. Page's report in the report of the Minister of Public Works for 1868.) The following report of the Commissioners of Public Works gives the state of this channel on the 27th September, 1848, about one year after dredging operations had been stopped:—

APPENDIX J.

PUBLIC WORKS,
MONTREAL, 18th October, 1848.

The Commissioners of Public Works have the honor to report, for the information of His Excellency the Governor General in Council, that being strongly impressed with the necessity of submitting to the Legislature, at the opening of the next session, a correct report of the present state of the New Channel through lake St. Peter, about which so many contrary statements are in circulation, they have thought it their duty, not to omit taking the advantage of the present low water season to make a personal visit to the works which have been carried on for several years past at the public cost.

Accordingly, on Wednesday, the 27th ultimo, the Commissioners embarked on board the steamer "Vulcan," accompanied by D. M. Armstrong, Esq., M.P.P., Capt. C. Armstrong, Mr. Rubidge, Draftsman, and Mr. Wright, (the two latter having been previously employed on the works), also accompanied by Capt. Dubord, and other assistants, with a view to make a complete inspection of the New Channel, and to ascertain with the greatest fidelity and exactness, not only its depth and width throughout, but also whether sand is being accumulated therein, which public rumor has so often stated to be the fact, and in consequence of which it will be progressively and quickly filled up.

The weather was most favorable; with a calm wind and clear sky, the operation of sounding was continued without interruption for several hours, in every part of the New Channel with great ease and precision. The result has proved that there is but little difference between the depth of water now and that of last year. As to the sand bank which is said to be forming and increasing at the upper entrance of this New Channel, the Commissioners were unable to discover it; but on the contrary, from the current being very rapid, it would lead to the belief that no obstruction is in existence there, and from the soundings, an average depth of fifteen feet is given. The excavation at this entrance to the Channel has, indeed, been made through a bank

of sand which is of about a mile and a half in extent, having only four to five feet deep of water thereon; but the particles of sand are intimately mixed with a soft unctuous clay to which they adhere, and the compound becomes stationary, and does not drift with the current. The Commissioners assured themselves of these facts, as to the nature of the bottom, by plunging a pole therein smeared with tallow. Upon this subject the Commissioners refer to the report of Mr. Rubidge.

The width of the Channel varies in some places from 100 to 150 feet. The total length where the dredges have been in operation, is seven miles, and there yet remains from one and a half to two miles to be excavated in order to complete the straight cut. To pronounce an opinion upon the intrinsic merits thereof, or of its relative merits when compared with the old and crooked Channel, for public opinion is nearly tranquil upon this part of the subject, and few persons now refuse to admit that if the money which has been employed in excavating the new Channel (still incomplete) had been expended in improving the old crooked and natural Channel, the commerce of the country would have been in possession of a navigation through lakè St. Peter, equal at all seasons of the year to the depth which can be obtained at other parts of the St. Lawrence between Montreal and Quebec. As before related, the only aim of the Commissioners is to give a plain statement of facts relative to the present state of this new cut, leaving the Government and the public to draw such deductions therefrom as they may seem to warrant.

E. P. TACHÉ.

M. CAMERON.

Comparison of Soundings in the New Channel of Lake St. Peter, taken on the 27th September, 1848, and the previous years of 1846 and 1847, all reduced to lowest water, or 11 feet on the flats. Old Ship Channel:—The results given being the mean depth taken in a cross section of 150 feet in width at the places mentioned.

POSITION OF SOUNDINGS.	Mr. Keefer and Capt Vaughan 1846.	Capt. McKim. 1847.	Mr. Rubidge. 1848.
	Feet. in.	Feet. in.	Feet. in.
Entrance at 1st buoy	15 0	14 7½	15 0
Midway between 2nd and 3rd buoys.	11 9½	13 8½	15 0½
Do. do. do. do.	12 2	13 10½	13 7
At 3rd buoy	12 5½	11 3	11 11
Near do.	12 5½	11 6½	12 10½
At 4th buoy	12 5½	12 8½	13 6½
Midway between 4th and 5th buoys.	12 9½	.. ..	12 9½
At 5th buoy	13 3	13 5½	12 3½
	12 11½	12 6½	13 2
	12 5½	.. ..	.. ..
At 6th buoy	11 10	12 9½	12 10½

(Signed,)

F. P. RUBIDGE.

Nothing more was done in Lake St. Peter by the Commissioners of Public Works, and in virtue of an Act passed in August, 1850, the work of improving the Ship Channel was transferred from the Commissioners of Public Works to the Harbour Commissioners of Montreal. In October, 1850, the Harbour Commissioners instructed Messrs. Wm. Gibbs Macneil, John Child and S. Gzowski as a Board of Engineers, with the assistance of the Provincial Geologist, Sir W. E. Logan, to report on Lake St. Peter, with the view of adopting the best means for obtaining a 16-foot channel at the lowest stage of water. Their investigations resulted in their recommending the old or natural channel to be improved, and the straight channel to be abandoned, as seen in the following report:—

Letter of Instructions from the Montreal Harbour Commissioners to the Board of Engineers appointed to survey Lake St. Peter.

[COPY.]

MONTREAL, 22nd October, 1850.

GENTLEMEN,

Some five years ago, it was determined by the Provincial Government of Canada to improve the navigation of the St. Lawrence between Quebec and Montreal, so that a vessel drawing 16 feet water should be able to sail up or down in any stage of the water. Mr. Atherton, in 1844, then in the employ of the Provincial Board of Works, surveyed Lake St. Peter, and reported in favor of deepening the present natural channel. This was opposed by the President of the Board, Mr. Killaly, who advised the cutting of a new and straight channel. This plan being adopted, the work was placed under the superintendence of Mr. David Vaughan. While this work was going on, a strong party sprung up who opposed the construction of this straight channel, which, they stated, would be unsuccessful, and that at least 600 feet of a breadth, at its upper end, would be required—that for the purposes of the trade its very straightness was an objection, &c. An outlay of some \$320,000 had been made in

this new channel, when the Government, on the report of a committee from the House of Assembly, stopped the work in 1846. We would refer you to the reports of Mr. Atherton, Mr. Young, the Committee of the House of Assembly, Captain Bayfield, and Captain Boxer, R.N.

The deepening of Lake St. Peter, and the improvement of the navigation, between this city and Quebec, is now placed under our control, and we have called on you, as gentlemen of experience in your profession, to examine fully into the whole matter, and report to us the best means of effectually opening a channel of 16 feet in low water between this place and Quebec, as well as the cost of opening a channel of 13 feet, 14 feet, and 15 feet.

We have placed at your disposal two branch pilots, Messrs. David Bouillie, Branch Pilot No. 2, Zephirin Mayrand, do., do., on whose statements you can rely, and who are practically acquainted with the towing of vessels, and the various channels and places which require dredging. A steamer is placed at your disposal, and you will be supplied with boats or whatever else you may require in the survey.

The foregoing remarks, we believe, embrace the plain facts, and as you are now acting as our Board of Engineers, without and entirely unconnected with local interests or prejudices, we believe you will be enabled to arrive at a comprehensive result, and give us such a report, with your reasons for your opinions, as shall have weight with those who may desire to be convinced of their correctness, before advancing the necessary funds to complete the work; this latter remark is the more necessary from the conflicting views which exist on the subject.

We are happy to say that W. E. Logan, Esq., Provincial Geologist, a gentleman of great eminence in his profession, will accompany you in the hope that he may be of service in determining the character and age of the deposits in Lake St. Peter.

We are, Gentlemen,

Yours very respectfully,

(Signed,)

JOHN TRY, *Chairman.*

JOHN YOUNG.

LOUIS MARCHAND.

To General McNeil, Captain Child, and S. Gzowski,

Board of Engineers to examine and survey Lake St Peter.

MONTREAL, 31st October, 1850.

To the Hon. the Board of Harbor Commissioners of Montreal.

GENTLEMEN,—

Having accepted the responsible trust confided to us as your Board of Engineers, we, on the receipt of your instructions of the 22nd instant, proceeded to the discharge of the duties devolved on us, as specified in those instructions.

Accompanied by your President and Secretary, experienced pilots provided, in fact, with every facility essential to the speedy and accurate attainment of our object, we embarked in the steamer "Richelieu" that afternoon for Sorel—where we had the pleasure to be joined by Mr. Logan and Captain Armstrong, and early the next day (Wednesday, 23rd) reached our main field of operations, Lake St. Peter.

Under favorable auspices, the calmness and clearness of the weather, and, consequently, smoothness of the lake, we commenced soundings with a pole graduated to feet and inches, and making such other surveys, examinations, and observations as, in our judgment, would suffice to disclose with sufficient minuteness all the facts to enable us, as you desire, "to arrive at a comprehensive result, and to give you such a report, with reasons for our opinions, as shall have weight with those who may desire to be convinced of their correctness before advancing the necessary funds to complete the work."

1st.—To ascertain the nature and character of the materials forming the bars and flats which obstruct the navigation of the river and lake, frequent borings were made, and specimens preserved for analysis by Mr. Logan, to whose communication on the subject, (hereto appended), we would respectfully refer you; and from the tenor of which it may be confidently assumed that the flats of the lake are an alluvial deposit of a very fine clay, slightly intermixed with sand, formed by the river drifts of the St. Lawrence, and its subsidiary arms, which meander through the islands and debouche at the head of the lake, together with the lateral tributaries, the rivers Yamaska, St. Francis, and others of less capacity.

It may be inferred, as experience has proven, that material of such description is easily excavated by dredging and the use of the harrow; and yet its consistency is such that it does not seem from previous excavations to have silted up; obvious, however, would be the necessity of concentrating the several currents, as far as practicable, into one channel, thereby materially aiding further excavations, and as a permanent security against a re-deposit of obstructions once removed.

2nd.—We proceed to state the direction and character of existing channels, comparing the soundings and the velocities of currents of the old and new channels with each other as determined by ourselves, and also by Captain Bayfield, R.N., and others.

The facts under this head are summarily exhibited in the following table:—

TABLE 1.

Shewing the Soundings taken in the Straight Channel, in the years 1846, 1847, 1848 and 1850; also those in the Old Ship Channel, all reduced to low water of 11 feet on the Flats, the results being the mean depth in cross sections of 150 feet in width, commencing at the head of the cut for the New Channel, and at the Upper Bar for the Old.

Soundings.	1846.	1846.	1847.	1848.	1850.	Soundings of Old Ship Channel by Board of Engineers.
	By Mr. Keefer and Capt. Vaughan.	By Captain Bayfield, R. N.	By Captain McKim.	By Mr. Rubidge.	Board of Engi- neers, 23rd, 24th, 25th October.	
1	15 0	Captain Bayfield reports, on 17th September, the depth to be at least as much as previously reported, if anything increased. Again, that there is no perceptible change in the relative depths of the two Channels, for 16 years, or since his survey of the Lake, in 1830, except at the head of the new Channel, where a considerable portion of the former shallow bank has been cut away by the action of the current, as shown by the red dotted line on the Chart.	14 7½	15 0	14 2	On the Upper Bar, 1st mile, average 15 feet, 12½ feet minimum. Thence a deep Channel for 3 miles.
2	11 9½		13 8½	15 0½	13 10	
3	12 2		13 10½	13 7	13 2	
4	12 5½		11 3	11 11	13 3	Thence for 2 miles on the 5th and 6th miles, 11 feet 8½ in.
5	12 5½		11 6½	12 10½	.....
6	12 9½		12 8½	13 6½	13 10	Thence for 1-2 or to the 8th mile, 11 feet 9½ inches.
7	13 3		.....	12 9½	13 9
8	12 11½		13 5½	12 3½	13 2	Thence for 1-2 mls., or to the 10th mile, 12 feet 9½ inches, on 10th mile, 13 feet 9½ inches, 10½ miles, 13 feet 3 inches.
9	12 5½		12 6½	13 2	13 9	
10	11 10		12 9½	12 10½	13 7	

The average depth of water in the straight channel, for a distance of 2½ miles from the point to which dredging operations were carried, is 12 feet 9 inches.

The "position of soundings" by Messrs. Keefer, Vaughan, McKim, and Rubidge, is more particularly stated by localities named by them, answering however very approximately to the distances assumed above by us.

From the foregoing it appears that for a period of five years, from 1846 to 1850, inclusive, the new channel has, to say the least, generally maintained the depth to which it had been dredged. In fact it has increased in depth even beyond that represented by the soundings of Mr. Rubidge in 1848, excepting for a short distance at the head of the channel, where he reports 10 inches to 1 foot more water than we do. This, however, we do not deem material, as we think it easily accounted for from the fact that the excavated *sand* of which that portion of the cut is formed, although displaced in tempestuous weather and by the currents, was yet too heavy to be far removed, and by its gravity was soon deposited where it now is. This seems the more probable, because of the generally increased depth of the channel below, where the bottom consists, as hereinbefore stated, of a very fine clay, which, when disturbed, does not readily subside, but mingles with the waters, and is carried off by the current; in which supposition we are fully supported by the report of Mr. Logan, which determined the light and flocculent character of this clay, and which, in our opinion, fully proves that with proper concentration of currents and the application of mechanical means, in the first instance, to disturb and remove the material, permanency in the depth of any adopted channel will be secured.

TABLE No. 2.

Exhibits the comparative velocities of the currents in the old and new channels per mile, per hour :—

OLD CHANNEL.	NEW CHANNEL.
Below the Upper Buoy 1·58 per mile, per hour.	At the head of new cut 1·45
Half way between the Lower Light and Buoy 0·67	Lower end 0·59
At Lower Buoy 0·81	One mile above lower end of cut 0·54

The velocity of the current at end of Stone Island in the main channel,
1·58 per mile, per hour.

It may be satisfactory to append, in connection with the foregoing, the following extract from the report of Captain Bayfield:—

“Although the first cut is incomplete, and has not been carried much below the 6th buoy, a current of considerable strength has already been established, fully equalling, if not exceeding in rate, that which obtains in corresponding points of the old channel,—for instance, at the 2nd buoy of the new channel, the rate was $1\frac{1}{2}$ knots, while at the upper light it was $1\frac{1}{2}$ knots; at the 7th buoy, $\frac{3}{4}$ knots, and at the lower light vessel $\frac{1}{2}$ a knot. These facts show that there is no tendency in the new channel to fill up, which is ascribed to the direction of the resultant of the currents of the main streams which unite a short distance below Stone Island, and also to the strong current setting to the southward past the point of the marshes that extend from Monk Island, and lastly, by the action of the current, in cutting away the banks between the red dotted line and the first buoy, which southerly direction is deemed very important.

“But with reference to the improvement of the old channel, it would be unsafe to leave the new channel open, because the very considerable water now passing through it would lessen the chance of any cut that might be made through it remaining open.”

We concur with the above-named justly distinguished authority as to the existence of a current of considerable strength through the straight channel and its probable increase, and that there is no tendency to fill up; but we differ with Captain Bayfield in the fact as stated by him, that a greater velocity of current exists in the new than in the old channel. We find it otherwise, as stated in the foregoing table, from the obvious fact that from the direction of the waters of the St. Lawrence, whether by the main stream, or through subsidiary channels among the islands, and the inclination not southward but northward at the head of the lake, and after it has passed the marshes extending below Flat Island, that the greater volume of water would seek an outlet by the old channel, and the same cause does operate in favor of the velocity of current in the old channel throughout, until when, from the influence of currents from the subsidiary chan-

nels entering the lake north of the main channel a southern inclination from the lower light obtains to the junction of the two channels opposite the river Machiche.

We also agree with Captain Bayfield that it would be unsafe to leave the new channel open in the event of improving the old one, while the same course of reasoning, will, in our opinion, justly apply to prove the necessity of stopping the old channel should the improvement of the new channel be decided upon.

In addition to the foregoing considerations, it is proper, before entering upon the estimates of the costs, to announce this principle of concentration of water into our channel as the indispensable guide to a conclusion, upon which we can ourselves rely, and by which the objects as stated in our instructions, viz.: "The best means of effectually opening a channel of 16 feet depth in low water through Lake St. Peter, as well as the cost of same, and also the cost of opening a channel of 13, 14, or 15 feet," can be effectually and satisfactorily secured.

In fact, no one can doubt that much water now flows through both channels, diminishing the supply in each separately, and, as a consequence, if either were closed, the current through, and depth of the other, would be proportionably increased.

In connection then with cost of excavations to deepen either channel within prescribed limits, we must look to the practicability and cost of effecting such a concentration.

For instance, if we would effectually improve the new channel we must direct the waters flowing through the subsidiary channels into the main channel of the St. Lawrence, and by the construction of dams and jetties direct the accumulated body of water fairly into it, and also close the old channel.

If, on the other hand, the improvement of the old channel is to be effected, the same principle of concentration applies; we have but to allow the waters of subsidiary channels to flow on naturally, for they chiefly come down in the desired direction, and to complete the work of diverting the whole of the main current of the St. Lawrence to throw a groin in a north-easterly direction from the flats of Monk Island, and thence by a dam across the new channel to the bar north of it.

With these considerations we have the means of instituting a comparison of the two channels—or, rather to determine in what

direction it may be advisable in our opinion to make a channel answering the conditions specified in our instructions; for, independent of all pre-conceived opinions and local prejudices, we regard either channel, or both, as but natural features to be availed of, so far only as they may not impair or conflict with the main object—*which object is the making of the best practicable channel through the Lake St. Peter.* Unquestionably, one or the other, the old or the new channel, indicates where the channel in view should be, and to determine which shall be adopted, we proceed to compare them.

It will be shewn that at each and all of the several widths and depths assumed, the old channel has greatly the advantage in point of cost; nor does it appear unfavourably on comparison of the soundings or the velocity of currents.

The new channel being straight throughout, is about three quarters of a mile shorter than the old, which is termed *crooked* by comparison, but which, nevertheless, is not, from all that we can learn, inconveniently so, as to cause us to attach as much weight to the objection as obtained in the opinion of many others of high authority. In other words, we are satisfied that were it of the desired depth and width for *large vessels* throughout, the inconvenience alleged would not be experienced. Certainly a new channel would not be sought as a remedy for obstructions caused by river drift, which may be removed as easily from the one as the other.

In viewing this case *de novo*, we cannot but observe that nature should be aided by artificial means, and not forced from her ordinary course, and with high respect for the opinions of others we must take her suggestions from the present, rather than a very remote past period of time.

Although the main channel through the lake may have once been in the direction of the new cut, yet the interposition by nature herself of the extensive St. Francis Bank has for an indefinite period effectually and permanently modified her own work, and produced the present old channel, which we think may now be justly called the natural channel, it being the deepest, most central through the lake, and drawing without artificial assistance vastly the larger portion of all the waters of the St. Lawrence River.

Again, the risk of vessels coming into collision at the curves of the old channel, or within the new channel, in consequence of its straightness, seems to us to have been unreasonably magnified.

No channel can be safely navigated without care, and we know from daily experience that where accidents are most apprehended they least often occur. It is clear also, that great width of channel, with moderate crooks, is better, the depth being the same, than a straight and narrow one, as in the present instance. But any improved channel, however narrow or crooked, (far more so than either of these), may be rendered safe by such regulations as may be established by the constituted authorities—in illustration of which the River Clyde of Scotland furnishes a prominent example. Furthermore, the adoption and perfection of the new channel involves the stoppage of the old one, and thereby will force the whole trade of the river through the new channel, thus rendering its enlargement at once to a width of 100 fathoms absolutely necessary, while the character of the entire bottom of the old channel, shewn by Mr. Logan to be lime clay, easily removed by harrowing, relieves that channel from the difficulties stated, as apprehended by Mr. Killaly from the entanglement of the passing vessels with the buoys, boats and rigging employed on the work. Nine-tenths, however, of the bottom of the new channel is of the same material as that of the old, and as easily removed by similar means, while the cut through the St. Francis bank is chiefly coarse and fine sand, which must be taken out by dredging. When thus fully excavated throughout to 100 fathoms in width, and the principal part of the St. Lawrence waters turned therein, the new channel would doubtless have a slightly stronger current, and be more acceptable to all concerned than the old one. But the above considerations viewed in connection with the estimates will shew if the advantages of straightness and consequent reduced length will compensate for the greater cost—for from our premises it follows that this difference of cost may be so great as to more than counterbalance the slight curves of the old channel. The results of these estimates are as follows in tabular statement:—

TABLE OF COSTS.

WIDTH 150 FEET.				WIDTH 300 FEET.				WIDTH 450 FEET.				Depth.
Old Channel. Cost.	New Channel. Cost.	Difference.		Old Channel. Cost.	New Channel. Cost.	Difference.		Old Channel. Cost.	New Channel. Cost.	Difference.		
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Ft.
9729 19 0	13685 13 4	3895 14 4		16253 1 4	28457 13 6	10204 12 2		19461 12 1	36166 15 8	14685 3 7		13
16621 16 3	21709 8 6	5087 12 3		25359 18 9	46040 17 1	20180 18 4		32240 11 9	67275 6 10	34634 15 1		14
22303 5 6	36659 14 0	14356 8 6		37225 11 2	70851 0 3	33625 9 1		48104 8 10	97654 17 7	49750 8 9		15
28201 3 10	47898 8 4	19697 4 6		49624 18 10	88235 17 3	38580 18 5		65040 7 0	128652 8 1	68612 1 1		16

Estimates as much in detail as our time will admit are hereto annexed, and marked A. and B.

These results show that at 13 feet depth of channel and of the respective widths of 150, 300, 450 feet, the differences in favor of the old channel are £3,935 14s 4d, £10,204 12s 2d, and £16,685 3s 7d. At 14 feet depth £5,087 12s 3d, £20,180 18s 4d, and £34,934 15s 1d. At 15 feet depth, £14,356 8s 6d, £33,625 9s 1d, and £49,750 8s 9d. And at 16 feet depth, £19,697 4s 6d, £38,580 18s 5d, and £58,812 1s 1d. Or the cost by the old channel at 16 feet in depth and 300 feet in width is but £1,722 10s 6d more than by the new of half that width; and at the same depth and a width of 450 feet the cost of the new, (£123,852 8s 1d), would be double that by the old, (£65,040 7s 0d). In fact any available amount of money will furnish more improved accommodation by the old than by the new channel.

Viewing, therefore, in any aspect of width and depth, we think that the greatly diminished cost of improving the old channel more than compensates for its few curves and slightly increased distance.

There are two other considerations worthy of note, one is, that in addition to the diminished cost, a greater volume of water can be diverted into the old than into the new channel, and with a far less risk to the stability of the works required to be constructed for that purpose.

2nd.—It has not heretofore been contemplated to dispense with the old channel, on the contrary, at the greatest width heretofore proposed for the new channel, to wit, 300 feet, "that breadth being sufficient for the special and principal purpose of enabling ships of heavy draft in tow of steamers to pass the lake." Rafts are to be forbidden its use, "lest they should injure the buoys or get in the way of vessels, neither is it to be used by night, "the present ship channel remaining sufficient for the general purposes of trade."

If then, as we have asserted, as much water as can be practically and with ease accumulated should be thrown into one channel, and hence the propriety of closing the other, and 300 feet width be not sufficient for the general purposes of the vast trade destined to seek the St. Lawrence as its favored avenue, it follows that a wider channel is advisable; and we, on mature deliberation, recommend 450 feet as the proper width of the contemplated channel to be excavated to the depth of 16 feet.

Such dimensions naturally point to the old channel, which, for a distance of about five miles, presents a superabundant width and depth of water, and for the remainder of its extent is as easily to be widened and deepened as the corresponding part of the new channel; and for this and other reasons stated, we are of opinion that you should *adopt the old channel* for improvement and shut up and abandon the new. We cannot perceive any cogency in the argument that more money should be spent to attain an object for which much has already been ineffectually expended, when, as in the present instance, a less sum applied in another direction will attain that object.

We estimate that three steamers of 150 horse power each, with properly constructed harrows as large and heavy as can be drawn five to six miles the hour, will produce 13 feet depth of water in the old channel 450 feet wide throughout in one season's work, from the opening to the close of navigation; also that 14 feet depth will require the same power two seasons; 15 feet depth three seasons, and 16 feet depth four years.

The same ultimate effect could not be produced in the new channel in a less period than six years.

The improvements of the navigation below Lake St. Peter, namely, on the *Poulier* and English Bars, require for the present, in our opinions, no further expenditure than the placing of buoys designating the position of the bars, but it may be advisable at some future period to make a wide passage through the English Bar, which will admit of vessels taking a direct course.

At Ile Platte there are two bars—one extending for a distance of 343 feet, the other for a distance of 1666 feet.

The proper way of permanently improving the navigation at those points is to dredge a channel of six hundred feet in width to a depth of sixteen feet; the estimated cost of such a work will be £2075.

The material to be removed on these bars consists of soft clay and sand, and at a short depth below the surface the clay is of the same description as that found in Lake St. Peter, and may be removed by harrows.

The economy and success of hydraulic works, such as form the subject of this investigation, especially require the superintending care of a scientific and experienced engineer, and as it is far

cheaper in the end to employ skill already acquired, rather than incur the mistakes and current losses of teaching, we recommend that these improvements, when resumed, be placed in charge of a competent civil engineer and an experienced assistant, the latter of whom shall reside constantly on the work.

Having been informed that considerable piling had been done north of Flat Island, to divert water into the new channel, we were led to look into the condition of the work constructed and its effect upon the current, but found that nearly the whole had been destroyed—probably by the ice; we therefore present the annexed section and plan of a piled dam, such as we believe will be both cheap and durable.

The piles being deeply driven into the bottom of the channel and sunk at least two feet under the surface of low water, and supported by banks of earth and stone (as represented in the section), thereby giving the ice room to form, and pass over the dam.

In conclusion, although it does not come within our province as engineers, yet we cannot, in connection with the subject, but naturally advert to the immense and growing interests to be accommodated and promoted by any and every improvement of the St. Lawrence, nor do we know of any more important than that which you now contemplate.

The St. Lawrence—the natural outlet of the great lakes—and they connected by railroads and canals with the Ohio and the “Mother of Waters, the Mississippi,” the great, the “far West” is directly and largely interested in its unobstructed navigation, and to an extent that must insure at an early period its safe, unobstructed and free passage.

To this condition it will, ere long, come, for it does not consist with right or reason, or the enlightened spirit of the age, that obstacles be permitted to exist against the will and interests of the commercial world.

We have the honor,

Gentlemen,

With the highest respect, to remain

Your obedient servants,

WM. GIBBS MACNEIL.

JOHN CHILD.

S. GZOWSKI.

[COPY.]

STEAMER "RICHELIEU," ST. LAWRENCE RIVER,
October 21st, 1850.

To W. E. LOGAN, Esq., F.G.S., Provincial Geologist.

SIR,—

Having accompanied us during the past week in our examination of Lake St. Peter for the purpose of determining the best mode of deepening the ship channel through said lake, and having witnessed the measurements, water soundings and bottom borings in the two principal channels and elsewhere, we shall now be glad to receive from you, in writing, such information as you can readily give on the following points:—

1st. The analyses of the following specimens obtained, namely: one from Ile Platte and two from the new channel—being one from the head, and one from a mile above lower end; three from the old channel, namely—from upper bar, lower light, and buoy, and one from the English Bar near Pointe du Lac.

2nd. The nature or origin of the formation from which these specimens have been taken.

3rd. Your opinion relative to the effect of the present or moderately increased currents upon the materials constituting the flats, bars, and channels of the lake.

With the highest respect,

We are,

Your most obedient servants,

(Signed)

WM. MACNEIL.

JOHN CHILD.

S. GZOWSKI.

Board of Engineers appointed by the Montreal Harbor Commissioners for the examination of Lake St. Peter.

MONTREAL, 30th October, 1850.

GENTLEMEN,—

In compliance with the wish expressed in your communication of the 28th instant, I beg to state the results of such mechanical analyses as the time has permitted, of the specimens to which you allude, obtained in your borings in the bed of Lake St. Peter and neighbouring parts of the St. Lawrence.

1. From the bar of Ile Platte. The bottom of the river in this part appears to consist of clay, with a thin and probably partial coating of silicious gravel occasionally mingled with sand. The auger was with difficulty made to bore 3 feet of the clay, and the specimen obtained gives, after drying, 3 per cent. of sand, the remainder being nearly pure clay.

2. From the upper bar in the old channel. The bed of Lake St. Peter is here a soft, argillaceous mud, through which the auger was pressed without difficulty to the depth of 12 feet. The material is a blue nearly pure clay. The depth of water was here 14 feet, the rate of current in miles and decimal parts 1.51.

3. From the lower light ship. The bottom in this part is exactly the same as in the previous instance. The auger was without exertion pressed through 14 feet, and the material is a nearly pure clay. The depth of water was 13 feet 2 inches, the rate of current 0.91.

4. From the lower buoy. The bottom here much resembles that in the last two instances. The weight of one man was sufficient to press the auger through $13\frac{1}{2}$ feet of the deposit, of which the first six inches appeared to be rather tougher than the remainder. The material in the lower part is a nearly pure clay. A specimen taken midway between the lower light ship and the buoy, another two miles below the buoy, and a third four miles further down give nearly the same results. In the three cases the auger with little pressure sank over 13 feet in the mud. The depth of the water at the lower buoy was 14 feet, the rate of current 0.81.

5. From the head of the new channel. In this place the bottom consists of sand; the auger was with difficulty worked through $5\frac{1}{4}$ feet, the top of which holds 48 per cent. of clay, the bottom 17 per cent. of the same, the remainder in each case being

coarse sand. The larger quantity of argillaceous material at the top appears to arise from the presence of a thin stratum of clay overlying the sand. The depth of water was 15 ft. 3 in., the rate of current 1.45 m.

6. From a point about a mile and a half above the lower end of the new channel. The bottom here is nearly the same as in the instance of No. 4. The borer sank with little pressure through 11 feet. The first six inches were rather tougher than the remainder; they gave a clay with 8 per cent. of sand; the remainder is a nearly pure clay. A specimen taken a little higher up in the new channel, and another from the lower end, give nearly the same results. At the lower end of the new channel the depth of water was 14 ft. 4 in., the current 0.59 m. per hour.

7. From the Upper or *Poulier* Bar, near Pointe du Lac. The bottom here consists of tough clay, through which the borer was with difficulty worked $2\frac{1}{2}$ feet. The Lower or English Bar, near Pointe du Lac, has a covering of gravel on which the borer had no effect; but from its proximity to the upper bar it seems probable that this gravel is underlaid by a similar clay, and that a partial coating of gravel will be found to invest the upper bar. On the *Poulier* Bar the depth of water was 18 feet, the rate of current 1.17 m. On the English bar the water was $15\frac{1}{2}$ feet, the rate of current 0.99 m.

On desiccation, the nearly pure clays, (which still hold a minute portion of fine sand not separable by any ordinary process of washing,) have the aspect of pottery clay, or fuller's-earth, and when rubbed with the nail or cut with a knife show a glossy surface, unctuous to the touch. In the deposits they are in a condition of very minute division; in those instances in which the auger sank with facility to the various depths mentioned, there is, of course, a large portion of water associated with the clays. In this state they are, by agitation, readily mingled with an increased amount of the liquid; and, on experiment, an ounce of the clay thus mixed with about thirty times its bulk of water, and left to subside in a vessel in which the mixture occupied a height of eight inches, (and in which the clay, if pressed into a solid mass, would not present a thickness of more than a quarter of an inch), after resting twenty-four hours, still remains suspended to

the height of three inches in so very light and flocculent a condition, with two and a half inches of opaque, turbid water over it, and half an inch of clearer liquid above, that the most gentle current would be sufficient to float it away.

The argillaceous deposits of the lake, notwithstanding their softness, are in most places, and in the new channel more than in the old, covered with a skin holding a small and varying amount of sand, which gives it a sufficient degree of tenacity to resist the wear of the present currents, and it seems to me probable that once brought to a quiescent state, and thus protected, the deposits would resist even moderately increased currents where the bottom is free from abrupt inequalities of surface in their direction, but that the skin broken and the deposits by any means disturbed and agitated so as to bring them into suspension, such currents would be sufficient to carry the great bulk of the material to considerable distances. According to the best authorities, a velocity of three inches per second or 900 feet per hour at the bottom will just begin to work upon fine clay fit for pottery, and however firm and compact it may be, it will eat away the surface; yet no beds are more stable than those clays when the velocities do not exceed the rate indicated, for the water soon takes away the impalpable particles of the superficial clay, leaving the particles of fine sand usually associated with it sticking by their lower half in the rest of the clay, which they now protect, making a very permanent bottom, if the stream does not bring down gravel or coarse sand which will rub off this very thin crust and allow another layer to be worn away. A velocity of six inches per second will lift fine sand; eight inches will carry off sand as coarse as linseed; twelve inches will displace fine gravel, and twenty-four will roll along rounded pebbles of an inch diameter; to carry away angular fragments of stone as large as a hen's egg requires a rate of three feet per second.

With the exception of the various islands and their reed-producing prolongations, constituting the delta at the head of the lake, several of which appear to be composed of sand, it is very probable nearly the whole bed of the lake will be found to consist of the soft argillaceous mud which has been described. In some of the borings in this, fragments of one or two species of shells, at present inhabiting the river, were met with near the

surface, and at depths of seven and eight feet, shewing that the deposit is the drift of the river. The argillaceous mud was met with also in some of the numerous channels which intersect the sandy islands, leading to the inference, which, however, requires confirmation, that the clay may extend under the sand. Fragments of river shells were found associated with the sand also, so that whether it be over or under the clay, it is alluvial; and it would thus appear that no parts of the deposits of Lake St. Peter and its islands are the remains *in situ* of those clays and sands of ancient marine origin, which form a large portion of the immediate valley of the St. Lawrence and through which the main river and many of its tributaries have cut their way for considerable distances. It is from the ruins of these marine beds however of the post tertiary period, brought down by the tributaries and the main river, that the alluvial deposits of the lake are supplied. To pursue the material carried from each or any individual tributary, and point out its distribution and the effect it may have on the waters of the main stream, would require a much more extended investigation than the present; but it does not appear to me to follow, as a matter of course, that because a deposit is near the mouth of a tributary it is of necessity derived from it. To ascertain, for example, whether the material of the sand bank out in front of the mouths of the rivers Yamaska and St. Francis is supplied by them, would require an examination into the nature and quantity of the sediment brought by them during freshets and under other circumstances; and the force and direction of the currents then and at other times prevailing. This bank is a subaqueous continuation of Monk Island, the whole of which island is above the mouths of those streams, and cannot therefore be derived from them; and though it is not an improbable supposition that they may have contributed to the material of the subaqueous part, it is not impossible, also, that it may be due to a continuation of the supply which formed the island higher up. But whencesoever the sand is derived, there seems little doubt that the St. Lawrence current in the ship channel on the one side, and the currents of the tributaries on the other, have arranged and modified the form of the bank, and that this has reacted on the currents. It is probable that what is called the ship channel once ran from Monk Island straight through the lake, as it appears from Bayfield's soundings in 1832 there were

then traces of it lower down ; but the transverse action of the tributaries has so modified the distribution of the material as to produce a deflection of the St. Lawrence current in the channel in question, and carry it into what is called the old channel.

In respect to the soft argillaceous deposits, all the rates of current ascertained being greater than that sufficient to give to the bottom current the velocity required to remove fine clay, it may be asked by what cause such a retardation of the rate has at any time been effected as to permit the clay to come to a state of rest. According to what has been stated, the clay would fall at any velocity under three inches per second ; this is understood to be French measure. A bottom current of three inches per second would represent a surface velocity of 7·463 inches, French, per second, or expressed in English miles and decimal parts, 0·47 per hour. The lowest rate of current ascertained was 0·54 at a mile and a half above the lower end of the new channel. But in the old channel, midway between the lower light and buoy, two trials were made in one spot on different days. In the first instance the rate was 0·67, and we were informed by the light-man that the water was at the time six inches higher than it had been some hours before, in consequence of the effect of tide. In the second instance the rate was 0·73, when we were informed it was low water, the light-man's guage showing six inches less than on the previous trial. That the lower rate with the higher water was a tidal result, is evident from the fact that if the water had risen from increased supply, the current should rather have been stronger than weaker, unless the channel at the entrance could not carry off the increased supply so fast as the channels at the head gave it, which does not appear probable. If 0·70 be taken as the current when the slope of the river is unaffected by the tide, the retardation produced by an ordinary tide would appear to be between 4 and 5 per cent., and perhaps it is not assuming too much to suppose that some occasional combinations of tidal and fluvial conditions, such as extraordinary high tides and general low water in the river, with the temporary influence of wind, may effect a retardation of a quarter of a mile per hour, which is about the amount that is required.

I have the honor to be, with much respect,

Your most obedient servant,

(Signed,) W. E. LOGAN.

The Harbour Commissioners began operations in the present channel in June, 1851, and on the 8th of November of the same year the *City of Manchester* passed through the channel they had already dredged, loaded down to 14 feet draught, with 12 feet of water on the flats. The channel was then 75 feet wide.

It will be noticed that in the following report of December, 1852, the dredging done by the Board of Works in Lake St. Peter in 1844-5-6 is estimated by scow measurement to have cost 1s. 5½d. (29⅓ cents) per cubic yard; and further, in the report of March, 1855, it will be seen that Mr. Keefer found, by admeasurement of the excavated channel, that its actual cost was 2s. (40 cents) per cubic yard. The dredging done by the Harbour Commissioners in Lake St. Peter in 1851-2 cost 6½d. (10⅔ cents) per cubic yard. This was in dredging to the depth of 16 feet. By gradual improvements and experience in working dredging plant, the cost of dredging in Lake St. Peter had been reduced to 5½ cents per cubic yard in 1878, and, through improvements applied to the dredges and scows by Mr. Kennedy in 1879, and notwithstanding the dredging was to a depth of 25 feet, the cost was reduced in 1881 to 3⅔ cents per cubic yard.

Mr. Glass's Letter to the Hon. A. N. Morin, Provincial Secretary.

HARBOUR OFFICE, Montreal, Dec. 27th, 1852.

SIR,—

I have the honour, by direction of the Montreal Harbour Commissioners, to transmit to you herewith, to be laid before His Excellency the Governor General, along with this communication, the Annual Reports of their Engineer and Superintendent

of Works, in relation to the operations carried on in Lake St. Peter, the channel of the River St. Lawrence and the harbour of Montreal during the past season.

From these reports, it is hoped His Excellency will observe that the operations have been carried on with energy, economy and success combined. But the Commissioners are desirous of drawing His Excellency's attention more particularly to the following facts in relation thereto :—

First—That the actual cost of the operations, thus far, is considerably within the original estimate.

Second—That the annual cost of excavation is only 6½d per cubic yard; while the cost of the same description of work, in 1844, '45 and '46, under the superintendence of the Board of Works, was within a fraction of 1s 6d per cubic yard.

Third—That the channel, in Lake St. Peter, was deepened to the extent of 2 feet, and made 75 feet wide, in the first season's operations, and a vessel taken through the same, before witnesses, in the month of November, drawing that extra depth of water.

Fourth—That in the month of August, in the second season's operations, the channel—being then made 150 wide, and of the depth aforesaid—was declared available for public use for vessels drawing that extra depth of water, viz., 2 feet more than the water on the flats; that it is a matter of certainty that vessels drawing that extra depth of water passed through it, and that it was used by all sea-going vessels drawing 10 feet of water and upwards, throughout the fall.

Fifth—That on the 18th November last, the operations for deepening the Channel to 4 feet more than the depth of water on the flats were completed, and that the Channel will be available for public use on and after the reopening of navigation, for vessels drawing that depth of water.

Sixth—That the aforesaid improvements in the Channel in Lake St. Peter, and at the other points named in the accompanying reports, have been effected at a cost—independent of outfit—of £20,077 4s 1d; while, on the other hand, the Board of Works expended £38,267 7s 0d—independent of outfit—in excavation that yielded no practical result.

Lastly—That the channel, according to present appearances, will be completed in November, 1854, from the foot of Lake St. Peter upwards, at a total cost—including a large and ample allowance for loss upon the expenditure for outfit—of not exceeding £50,000 ; a sum which the Commissioners believe the public will eventually look upon as of no moment, compared with the important results which will flow from the improvements referred to—results which will be beneficial, not only to the city of Montreal, but also to the whole of the Province lying above it.

The Commissioners, however, are not unaware that some of their fellow-citizens consider it questionable whether that expenditure, involving as it does a tonnage duty upon all vessels visiting Montreal drawing 10 feet of water and upwards, is for the advantage of the city or not. Those persons seem disposed to maintain that it would have been better to have allowed the channel to remain in its natural state than to have improved it at such a cost. The Commissioners, I am instructed to say, differ entirely from that conclusion, and beg that they may be allowed to submit their views upon the question for His Excellency's consideration.

In the first place, it is well-known that for a long period in the fall of the year, the water on the flats in the Lake St. Peter falls to about 11 feet, and seldom rises above 12 to 13 feet till the shipping season is over. It is also known, that a vessel of 500 tons burden (about the smallest vessel that can profitably compete with the class of vessels now employed on other rival routes, and consequently chosen as the fittest example to illustrate the present argument,) can carry very little cargo in her when she has to pass through such shallow water. The consequence is, the bulk of her cargo, both inwards and outwards, has to be carried for her in lighters to and from Quebec, entailing a very heavy expense upon the owners, and seriously crippling the natural advantages of this city, arising from its position, in other respects. If, then, the necessity for employing lighters in the fall of the year, can be done away with at the cost of a moderate tonnage duty, it seems clear, I am instructed to say, to the Commissioners, that the city of Montreal will be a gainer from it, provided the tonnage duty is less than is usually paid for light-

erage; a point which seems to be clearly established by data appended to this communication, under the letter A, to which His Excellency's attention is respectfully invited.

The statement referred to has been made up with great care, after consultation with many persons of high respectability conversant with the subject; and the results shown are that, supposing the channel in Lake St. Peter were not deepened, a vessel of 500 tons burden, laden for Montreal, would be obliged to discharge fully 600 tons of her cargo, with even 12 feet of water on the flats, and that the cost of lightering the same from Quebec to Montreal, even at the low rate of freight of last season, would be fully £165; while, on the other hand, the tonnage duty on the same vessel, passing through the improved channel with her whole cargo on board, will be only at the present rate of tonnage duty £12 10s, showing a saving on the trip of £152 10s; a saving which seems to be conclusive as respects the question under discussion.

But it may be answered by objectors that the regular trader makes two voyages in the year, pays tonnage duty both voyages, and yet requires to use the improved channel only in the fall of the year. Granting this as true, it still follows that the vessel will be a gainer in the fall of the year, after deducting the dues for both trips, of £130, as shown in detail by the statement already referred to. And in the same manner it might be shown that the vessel would profit on her outward trips, from the channel; but it is considered unnecessary to multiply proofs where the case is so plain.

It is not, however, to the limited point of view thus far presented, that the Commissioners would wish to confine their examination of this important question. On the contrary, in contemplating the benefits likely to result from deepening the channel, they consider themselves warranted in expecting that vessels of much larger tonnage than those hitherto used in the trade with Montreal will be employed therein after the improvements are completed; and it is from this point of view that they draw the most favorable conclusions as to the benefits to be realized, for it seems to them clear that, if vessels of 800 to 1000 tons burthen can be enabled to reach Montreal throughout the season of navigation, without the necessity of employing lighters

as auxiliaries, and thus connecting with the large craft now employed in the inland trade with the West, that then the chief desideratum will be attained for enabling Montreal to compete with the most favored seaports elsewhere for the carrying trade, and the commerce of that immense region; and that little else will be required to give permanence to her prosperity, except the allowing the vessels of all nations to resort freely to her wharves in the pursuits of commerce.

With such views, and looking forward confidently to an increase of trade from the causes above referred to, the Commissioners, I am instructed to say, have also thought it their duty to anticipate the actual necessity for increased harbour accommodation; and, accordingly, some months ago, directed their Engineer, C. S. Gzowski, Esq., assisted by T. C. Keefer, Esq., to make a complete survey of the harbour, for the purpose of ascertaining to what extent accommodation could be provided for the water-borne traffic of the city. That survey has been completed, and the Commissioners hope in a short time to receive the report and plans of the Engineers, which they will do themselves the honour of submitting, on receipt, for His Excellency's consideration. In the meantime, however, I am directed to remark that the survey has demonstrated that it is practicable to provide accommodation within the harbour for any probable increase of trade, at a cost which may be considered not excessive, when compared with the importance of the interests at stake, and the benefits to result from the expenditure.

I have the honor to be, sir,

Your most obedient servant,

JOHN GLASS.
Secretary.

Hon. A. N. MORIN, M. P., Provincial Secretary, Quebec.

APPENDIX A.

A vessel of 500 tons burthen, loaded with a full cargo for Montreal, will draw, on her inward trip, generally about 16 feet-9 inches, and will carry, on an average, about 600 tons of dead weight, or 1000 tons composed of weight and measurement goods together.

The same vessel, drawing only 11 feet of water, (low water on the flats of Lake St. Peter,) would be little more than able to stand upright, and would have very little cargo on board.

The same vessel, drawing 12 feet of water, might have on board as cargo 250 tons of dead weight, or 350 to 400 tons of weight and measurement goods together.

These facts have been ascertained from merchants well acquainted with the subject, and form what may be considered the general rules of the case.

Reasoning, then, from the foregoing data, it follows that, supposing the channel in Lake St. Peter were not improved, the generality of 500-ton vessels, loaded in full for Montreal, would have to lighter up in the fall of the year, with even 12 feet of water in the lake, (a foot more than often prevails,) fully 600 tons of cargo, composed of weight and measurement goods together; and the cost of doing so—ascertained from merchants and others engaged in the business—would be from 5s to 6s per ton all round, independent of the towage of the vessel.

Assuming then the cost of freight at the average rate of 5s 6d per ton all round, the charge for lightering 600 tons of cargo would be \$165; while, on the other hand, the tonnage duty upon the same vessel, passing through the improved channel in the lake, with a full cargo on board, would be, at the present rate of duty, only £12 10s—showing a net gain to the vessel from deepening the channel of £152 10s on the inward fall trip. But further; supposing the vessel to be a regular trader, making two voyages in the year, and deducting from the said gain the tonnage duty paid upon the spring inward trip also, the vessel would still be a gainer on the two trips of £130, from the substitution of tonnage duty for lighterage.

The above, however, is not the only saving to the vessel; for

to it must be added, a reasonable allowance for damage done to cargo in the operation of transshipping—also the cost of transshipping—and the expense arising from the vessel's being delayed by it; all which would involve, in the case supposed, a very considerable expenditure.

The saving effected by a vessel on her outward trips might also be shown in detail; but it is considered unnecessary to enlarge upon so self-evident a point.

(REPORTS REFERRED TO IN MR. GLASS'S LETTER.)

Report of C. S Gzowski, Esquire, respecting works carried on in Lake St. Peter, the Channel of the River St. Lawrence, and the Harbour of Montreal, for the season 1852.

MONTREAL, 18th December, 1852.

SIR,—

On the withdrawal of the vessels engaged in the work of improving the channel through Lake St. Peter and their removal to winter quarters, I have the pleasure of submitting, for the information of the Harbour Commissioners, a brief report of the operations during the last season, and of the results attained.

The operations on the lake were commenced in the latter part of May, and prosecuted with the utmost energy during the entire season, until the 18th day of November last. In addition to improving the channel in the lake, several other obstructions existing in the navigable channel between the lake and Montreal have been removed, and a great improvement effected within the limits of the harbour. For the detailed data as to the exact period at which the works were commenced and suspended, as well as to the kind of vessels employed at the different localities, I respectfully refer to a very satisfactory report of Capt. Bell, the Superintendent, which is hereto appended.

The result of the operations up to the close of the season shows that a channel of 4 feet in depth and 150 feet in width has been made through the flats of Lake St. Peter, which extends from the

lower floating light to the lower buoy, and of 130 feet in width from the buoy to a point about two miles below it, embracing in all a distance of about six miles, and admitting now of a passage through the lake for a vessel drawing four feet more water than the depth of water on the flats.

In addition to this, the bar which existed above the upper light, and which formed a barrier at the entrance of the channel, has been removed, and a passage made through it 200 feet wide, and corresponding in depth with that in the channel through the lake.

The shoals at "Ile Platte" have also been removed to an extent affording now a channel through both the upper and lower bars, of the same depth with that in the lake, and of not less width than 250 feet on the lower and 150 feet on the upper bar.

A shoal, found to exist at "Ile DeLorier," has also been removed, and a channel made through it 250 feet wide, and 16 feet deep at low water. In addition to this, much serviceable dredging has been done in the Montreal Harbour, and the entrance to it so far improved that, with but little more work, next season an uninterrupted channel will be secured through the harbour, admitting of vessel drawing 16 feet at low water.

The aggregate quantity of material removed at the different points, exclusive of that in the Montreal harbour, is equal to 740,892 cubic yards.

The total amount expended since the commencement of the works, including preliminary survey and all the outfit, is £42,110 19s 3d. The amount expended in actual operations, exclusive of the outfit, is £20,077 4s 1d.

By a reference to the report made to the Harbour Commissioners by engineers appointed by them to examine and report on the improvements to the navigation through Lake St. Peter, and the selection of a proper channel, it will be found that the cost of making a channel through the lake, between the lower light and below the lower buoy, 150 feet wide and 15 feet deep at low water, that is 4 feet deeper than the depth of water on the flats, was estimated at £22,313 5s 6d.

The actual cost of operations being £20,077 4s 1d shows the work to have been done within the estimates, and to a much greater extent than is even apparent in the mere difference

between the amount estimated and expended, as the sum paid for operations covers the expenditures at "Ile Platte," "Ile DeLorier," and in the harbour of Montreal, while the estimate was made for the work in the channel through the lake exclusively.

I attribute the result of having done the work so much within the estimated cost to a due regard to economy in all arrangements, and to the active and vigilant supervision of the daily operations of vessels and machinery.

To show how the present expenditure and amount of work done compare with that made in the straight channel, under the Department of Public Works, I will draw your attention to the following extract from the report of Mr. Rubidge, engineer in the service of the department, dated the 31st May, 1847, addressed to the Commissioners of Public Works, showing the result of the operations in the straight channel during the seasons of 1844, 1845 and 1846.

The report shows that the quantity of work done in the straight channel during those three seasons is 520,963 cubic yards, that the amount expended for outfit, adding depreciation for three years' service, is.....£31,606 9 3

And the actual cost of dredging 20,963 cub. yards is. 38,267 7 0

Making the total expenditure up to that period.... 69,877 16 3

Or at a cost per each yard of earth dredged equal to 1s 5½d, nearly.

The operations up to the close of the present (second)* season, under the Harbour Commissioners, show the quantity removed by dredging and rake to be 746,892 cubic yards, and the actual cost of doing that work to be £20,077 4s 1d, making the cost per yard 6½d, currency, or a fraction over one-third what it cost to do the work in the straight channel under the supervision of the Board of Works.

It is but right to observe also, that the future entire cost of the work will be proportionately less per yard, the outfit being now, I may say, almost complete, and all in good working order; its cost will bear a less proportion to the actual quantity of material moved, when the channel is made to its full width and depth, than when it is, as now, only one-third done.

*The operations of the first season were not commenced until the month of July.

Another point, which, without assuming more than the result of the season's work entitles us to, is, that the work has been tested and made use of, and that it has been most clearly and undeniably shown that vessels have passed through the new channel in the lake this season, drawing more water than what they have ever been known before to do. The width of the channel being only 150 feet, is not yet quite sufficient to allow vessels much lee-way while passing through it, but as long as vessels kept within its bounds, they could pass through it drawing two feet more water up to the 17th November, and four feet more of water since that date.

The result of the operations of the two past seasons, as to quantity of work done, and the expense incurred, with the certainty that now exists that a channel of 300 feet in width and 16 feet in depth, at low water, will be secured at the end of two seasons more, are, in my opinion, additional evidences that the channel selected is the proper one, and that the final results will be fraught with very great advantages to the trade.

I have the honor to be,

Sir,

Your obedient servant,

(Signed),

C. S. GZOWSKI,
Engineer.

John Glass, Esq., Secretary Harbour Commissioners.

[COPY.]

Report of Capt. John Bell, Superintendent of Works in Lake St. Peter, &c., &c., for the season 1852.

To the Montreal Harbour Commissioners :

GENTLEMEN,—

As our operations for the season of 1852 are now closed, it becomes my duty to lay before you a statement of the amount of work done and the good effected.

In the first place the dredges were taken into the lake on the 19th May, but, owing to the new boat not being ready, one of them only was kept at work until the 12th June, when the new boat started. From this until the 19th of the same month, they were both wrought without intermission. On this day the main shaft of the new boat broke, which we could not get effectually repaired till the 30th July. The *Albion* was chartered in her place, but owing to her want of power and the time she was absent with a broken bridge-tree she did not work more than half the time we had her. I mention these things to point out to you the great detention and delay from unforeseen accidents, which we had to contend with in the commencement of our operations this season; but, notwithstanding these delays, the two dredges have, up to the 18th November, or in 120 working days, removed 498,720 cubic yards, thereby forming a channel, about four miles long, from a little above the lower light vessel to the iron buoy, of 150 feet in width, and thence to deep water, about two miles long, of 130 feet in width, with four feet more water in it throughout, than the water on the flats.

The bar above the upper light vessel has also this summer been sufficiently removed to allow vessels to pass drawing 15 feet at low water. This improvement was effected by means of the *North America* and *Harrow*. This vessel commenced on the 4th May, and finished on the 18th June, making the channel about 200 feet wide, and removing in that time about 44,000 cubic yards. When finished here, her crew was for some time employed in laying down the buoys on the side of the channel, placing 27 on the south side of the channel through the flats, and three on the south side of the channel through the upper bar.

Dredge No. 1 was also very much detained by the breaking of some parts of her machinery; but, notwithstanding this, I commenced operations with her at Ile Platte on the 14th June, improving the channel which she made there last year by deepening it two feet, and increasing its width to 250 feet through the lower bar, and 150 feet through the upper bar. To effect this, she had to remove 15,000 cubic yards, and it was finished on the 28th August. From this place I sent the vessel to Ile DeLorier, where she cut a channel through the bar there of 250 feet wide and 16 feet deep at low water, removing in that operation 1,400

cubic yards and finishing on the 8th September. She was then removed up to the harbour of Montreal, where she continued to work until the close of the navigation, improving the channel entering the harbour, which she has not yet finished.

I may remark here that the improvements made upon the machinery and mode of working this dredge, last spring, have enabled her to do double the amount of work in much less time than she took last year. I should recommend you to make still further improvements upon this vessel, with the view of adapting her for lifting large boulders, of which there are many yet in the harbour to be removed; a description of which improvements I will lay before you at any time you may require it.

The spoon dredge has not done so well as I expected her to do, principally owing to parts of her machinery being too slight for the hard excavation we had to contend with in the harbour. This I propose to remedy with your permission this winter, by making certain improvements in her construction. She has, however, effected some improvements in the harbour, more particularly in the Creek Corner, the King's Basin, the Sydenham Basin, and the upper side of the Island Wharf, which could not have been effected by any other means.

In my letter to you, dated the 11th December, 1851, I stated that, by following certain plans, a channel of 15 feet at low water could be had by the end of the season of 1852; I am now happy to be able to state that such a channel actually exists, with the exception of one small bar opposite the Victoria Pier, entering the harbour of Montreal, on which there is about six inches less of water than we now have in the channel through the lake. This can be removed by Dredge No. 1, when the channel from the harbour to the foot of Lake St. Peter will be complete, and safe for vessels to navigate drawing four feet more than the water on the flats. But as this fact appears to be by many doubted, I respectfully request that you will appoint some qualified person to sound and examine the channel in Lake St. Peter, and report thereon. This can be done effectively on the ice, as soon as the lake is frozen over, and the length and width of the channel at the same time accurately ascertained.

The plan for future operations in Lake St. Peter will greatly depend upon the width you intend to make it. For my part, I

should prefer a deep channel 300 feet wide to a wider one containing merely sufficient water to float the vessel.

A channel of 300 feet wide and 16 feet deep, at low water, can be effected by our present means in two years. A channel 400 feet wide and 15 feet deep, at low water, can be effected in the same time. To obtain the first mentioned, I should in the spring, when the water is high, commence the widening of the present channel, and as soon as the water fell sufficiently to admit of our working in the present channel I should begin to make it a foot deeper. A great portion of it could be put down to this extra depth before the fall vessels would begin to arrive, and they would thereby obtain the advantage of it.

But if the channel of 400 feet wide were preferred, there would be nothing to do but to commence the widening of the present channel, and continue it till finished.

As respects the channel from the lake to Montreal, it will be necessary, some time next summer, again to place Dredge No. 1 at Ile Platte to widen the channel 100 feet through the upper bar, and deepen the whole of it one foot more. But on the opening of the navigation, I would recommend you again to place her in the harbour, as there are many places above the lower wharves where deepening is much required, and where she could work to advantage while the water is high, and as the water falls she could commence and finish the improvement of the channel entering the harbour.

I may add, in conclusion, that the amount of material to be lifted by calculation to make the channel what it is now represented to be, and the amount lifted by account, agree within a very few yards, which proves that our method of working the dredges is perfect; that is to say, that they leave nothing behind them which can cause obstruction.

I am, gentlemen,

Your most obd't. servant,

(Signed)

JOHN BELL.

In August, 1853, a test of the dredged channel was made, showing that fully four feet had been gained beyond the natural depth, with a width of 150 feet. The following extract from the *Montreal Transcript* of the 26th August, 1853, gives an account of the test:—

[*From the Montreal Transcript, Aug. 26, 1853.*]

Perhaps the most important subject connected with the local superiority of Montreal is the navigation of Lake St. Peter. Our readers are well aware that this has been the subject of warm controversy for several years. The lake is a great expanse of water, into which rivers flow, principally the St. Francis and Yamaska, at right angles, bringing down a great amount of alluvial deposits. The bottom of this basin is a blue clay, at a pretty uniform depth of twelve feet, at low water; but here and there, silted up to a depth of only a very few feet. The natural channel of the main current of the St. Lawrence is to the northern side, where it makes a great curve, and for the largest portion of its course has abundance of water; but there in an interval of several miles, over which the depth used to be about 11 feet 9 inches, necessitating vessels coming up to Montreal, or loading at it, to employ barges, at great cost and delay, to disembark or to embark a large portion of their cargo at Quebec. With such a light depth of water no sea-going vessel could pass up to Montreal, or down to Quebec, more than half loaded.

To remedy this great and acknowledged inconvenience, this interruption of an otherwise splendid navigation, the deepening, that is the dredging, of a channel through Lake St. Peter was commenced some dozen or more years ago. The plan adopted by the engineers of the day was to go right through—that is, to describe, as it were, a cord of the bow which the natural channel found. We are not going to enter into this controversy sufficiently warmly debated, which is now set at rest; the decision having been come to, and acted on, to abandon the direct channel and improve the circuitous one. This decision has now been acted on for about three years.

It is a question of some importance, not merely to the people of Montreal, but to the whole Province, whether the passing

along the cord or of the bow is the best. But the paramount consideration is that there shall be a practicable channel, with water enough permanently to float vessels such as their wants require. It is well known that of late, and particularly within these last two or three years, the tendency of the mercantile marine has been greatly to increase tonnage. Clipper vessels of 1,500 tons are now employed where, within our memory, schooners of 150, or brigs of 250, tons would have been thought sufficient, and indeed all that would be profitable. But, it is well known, that the larger a ship is the more profitable she is, if she can be loaded; and, from the vast extension of commerce, large vessels can now be loaded with as much expedition as small ones could formerly.

From this law Montreal was not exempt; indeed, she has become daily more subject to it, from the competition of the noble vessels received by the Atlantic ports. However, to all sensible men, the removal of this obstruction to her receiving vessels of large tonnage has been felt to be of primary importance; though it must be admitted that the people of Montreal, in general, have not paid to it the attention which it deserves.

There have been various reports recently current of the progress of this work. The representations of the official authorities have been uniformly favorable. Not merely the responsible parties engaged in the work, but these who were officially bound to see that it was done, stated that it was advancing most admirably—that is, that the channel was deepening, and four feet water had been gained. Our readers are very well aware that the difference of four feet water makes the difference between a small-sized merchantman lightened and a very large one with full draught.

A few days ago came up the California, Capt. Gall, drawing, we believe, somewhere about 15 feet water, and she ran aground. It was explained that, from the narrowness of the channel, or from some difficulty in the pilotage, the vessel ran aground on the bank; and we ourselves heard the Captain, who could have no possible bias, and who is now on his way across the Atlantic, declare, that on sounding, there was 17 feet in the channel. Be that as it may, the vessel was got off and brought up to Montreal without damage. The experiment, then, was fairly tried,—Capt.

Gall himself was so fully satisfied of the capacity of the channel, that he loaded his vessel to her full sea-going draught, which he estimated at 16 feet 2 inches.

The California started on Wednesday in tow of the steam-tug Alliance, Captain Johnston, which had on board the Chairman and Secretary of the Harbour Commissioners, and several other gentlemen of the city, whose numbers would doubtless have been larger but for the very early hour of starting. The voyage down presented nothing very particular until near Berthier, where the California slightly grazed several times on shoals of which the existence was previously unknown, being merely little collections of gravel thrown up by eddies. They had not been discovered, because no vessel of the like draught had ever passed over them. As they are, they are no great obstruction, and will be very easily removed.

The wide natural channel being then passed, the new artificial channel was next made. This we have explained, is an excavation of four feet, and something more, in the clay, which lies below the silt, and at an average depth of twelve feet below the surface of the water. The circumstances could scarcely have been less favourable to the experiment. The water was not above its average height; it was indeed the lowest of the season. It blew a stiff breeze from the south-east, which, as the current always sets over the flats to the northward, not merely diminished the depth of water, but compelled the steamer to lie a point, or a point and a half, south of her true course, in order to hold it against the wind and cross-current—that is, to go diagonally. But, in all her course, as we can speak from watching most carefully, the California never touched bottom. The trace of her keel was visible by the muddy water in her wake, for it is not pretended that there was more than a few inches to spare, which the drift of her passage would disturb; but she went through without the slightest delay or obstruction. Arrived at the deep water, anchor was cast, and the California being carefully measured by the pilots, was pronounced to draw 16 feet 1 inch. Captain Gall, a witness totally disinterested, deserves great credit for the confidence, where, after running his vessel aground coming up, on investigation of the channel he decided on bringing her down loaded still deeper.

This event is one of great interest in the history of the Port of Montreal. From 11 feet 9 inch, we believe it raises us to 16 feet 1 inch, which actually doubles the tonnage which can use our port without the assistance of lighters, the charge and delay of which has laid so heavy on our commerce. We hope the Harbor Commissioners will now be encouraged by public approbation to persevere. A very little expenditure and patience will give us, through the short distance to which it is obstructed, a clear depth of 17 feet through, to below Three-Rivers.—In a general way, this, with some improvements in the inner harbour, would allow us to receive vessels of one thousand tons burthen, and with these, we might command the whole trade of the west.

Without lavishing compliments on individuals, we should do an act of injustice if we were not to express the sense generally felt of the valuable services rendered by Captain Bell, the superintendent of the work. His zeal, industry and vigilance have been beyond all praise. The order in which he has all his machinery and the precision with which he has completed his work are admirable. It must be most gratifying to him to find that statements of his, which were at one time disputed, are now fully confirmed,

(Copy.)

ON BOARD THE STEAMER "ALLIANCE,"
Lake St. Peter, Aug. 24th, 1853.

We, the undersigned, invited by the Montreal Harbour Commissioners to witness the experiment of taking a vessel through the improved ship-channel, *from the Harbour of Montreal down to the lowest point in Lake St. Peter to which their operations thus far have required to be extended*, hereby certify that the California, Capt. Gall, of 487 tons burden per register, drawing sixteen feet one inch (16 feet 1 inch) of water, was successfully towed this day, under the superintendence of Capt. Bell, through the aforesaid channel by the steamer Alliance—and that on sounding the "flats" in Lake St. Peter, immediately after the experiment was made, we found only *twelve feet one inch* (12 feet 1 inch) thereon,

on the track formerly used by vessels—thereby proving conclusively that the improved channel aforesaid has been deepened to the extent of four feet.

[Signed.]

ROBERT GALL,
Master of the *California*.

HECTOR HAMLIN,
Branch Pilot.

CHRISTIAN MARAUSE,
Pilot of the steamer *Alliance*.

H. BELMARE,
Master of the Barge *Harmony*.

CHARLES JOHNSTON,
Master of the steamer *Alliance*.

G. L. ARMSTRONG,
Master of the steamer *John Munn*.

J. WILSON,
Owner of the steamer *Alliance*.

J. ARMSTRONG,
ROBERT ABRAHAM,
Editor of *Montreal Transcript*.

GEO. B. ROBERTSON,
Advocate.

LEON DOUTRE,
Deputy Registrar of Montreal.

DAVID BELLHOUSE,
Agent for the Contractors of the Canadian Ocean Mail Steamers.

JOHN LEEMING,
Alderman of the City, and Merchant of Montreal.

CHARLES SEYMOUR,
Merchant.

DAVID KINNEAR,
Proprietor of *Montreal Herald*.

At the close of the season of 1854 the channel was finished, with the exception of about 10 days' work, to a depth of $16\frac{1}{2}$ feet at low water, and of a width of 250 to 300 feet, as stated in the following report of 1855, which contains much information, and brings the account of the Lake St. Peter Ship Channel down to the year 1855 :—

ENGINEER'S REPORT.

MONTREAL, 1st March, 1855.

TO THE HONOURABLE JOHN YOUNG,
Chairman Harbour Commissioners, Montreal.

SIR,

I have the honor to acknowledge the receipt of Mr. Glass' letter of 6th January, transmitting the reports of Captain Bell, Superintendent of the Commission, with a request that I should report upon the same—review the past progress of the works—and give my views with reference to future operations.

The documents published in February, 1853, give a clear and connected history of the operations of the Harbour Commissioners up to that date. Since then, two working seasons have elapsed—the scale of operations has been materially enlarged by a decision to carry a depth of *twenty* feet at low water through Lake St. Peter, instead of one of *sixteen* feet, which was the maximum aimed at in the instructions to the Board of Engineers in October, 1850; and the question of the enlargement of the harbour of Montreal has been presented in a manner which indicates that this work cannot be much longer postponed. Moreover a survey of the river has defined the nature and extent and demonstrated the practicability of the removal of *all* the obstacles to the attainment of a depth of twenty feet at low water, above and below Lake St. Peter.

Under these circumstances the present appears to be a proper occasion for reviewing the proceedings of the past, as the best means of explaining, as well as of vindicating the arrangements the future.

I will endeavor, (at the risk of repetition,) to present the question so that strangers, without the aid of charts, may be able to appreciate the extent and importance of the work.

The rapids of the River St. Lawrence terminate at the city of Montreal,—from which point to the sea the *current* of the river offers no obstruction to the ascent of ocean craft.

The influence of the tides is felt within fifty miles of Montreal, but their regular rise and fall is not perceptible until we descend

about one hundred miles below this city, where the influence of the tide has been observed, the river expands into a lake about twenty miles in length by nine in width, called Lake St. Peter. This lake is crossed by three "banks" or "bars" which enclose between them two "pools" in which the depth exceeds twenty feet; the first of these pools is one and a quarter miles in length, and 800 feet in average width, and the lower one four and a-half miles in length and nearly half a mile in width. The ship channel is in the general direction of these pools, and near the centre of the lake, between it and either shore, there is a broad margin of shoal water, averaging two miles in width on the north and three and three fourth miles on the south of this channel.

The main "bank," which divides these two pools, is known as the "flats of Lake St. Peter," and measures, from a depth of twenty feet at low water in one pool to the same depth in the other, *eight and seven-eighth miles*. The top of this bank is very level, having a uniform depth of eleven feet at low water, for a distance of four and a half miles, measured on the line of the ship channel. Across the head of the upper and the foot of the lower pools are two bars which separate the main channel, entering and leaving the Lake, from the two pools above described. The least depth on the Upper Bar, (or *Batture du Lac*,) was twelve feet at low water, and the distance across this bar between the depths of twenty feet at low water, is nearly one and a-half miles. The depth on the Lower Bar, (opposite Nicolet River,) is sixteen and a-half feet, and its extent, between twenty-feet soundings on the line of the channel, is one and a-fourth miles.

The aggregate length of dredging at the Upper Bar, the Flats, and the Lower Bar, for a depth of twenty feet at low water, will be about eleven and a half miles, measured on the line of the old ship channel.

The average depth in the channel of the River St. Lawrence, between Montreal and Lake St. Peter, with the exceptions hereafter to be described, may be taken at thirty feet. Below Lake St. Peter the depth in the channel is generally thirty to forty feet, increasing as we approach Quebec, to sixty and one hundred feet and over, with the exception of that portion of the River opposite St. Anne de Pérade, where there is a general depth of twenty-four feet at low tide, and where the bed of the river is

strewn with huge rocks or boulders. Here there is a narrow bar of blue clay with only sixteen feet water upon it at low tide. At this latter point there is a tide of six and a half feet at springs, and four feet at neaps, so that at high water there is no obstruction to a twenty feet draught.

It is not to the purpose here to discuss the origin of the Flats of Lake St. Peter, further than this question bears upon the important one of the permanency of the artificial channel now in progress through the lake.

If the fine clay, of which the flats are formed, has been swept out of the numerous channels formed by the islands above Lake St. Peter, this has taken place at so remote a period, that the supply from which the flats were then formed has been exhausted,—and the river, having cut out its required dimensions of channel, has protected these from further encroachments by a lining of stones, sand, or gravel. The action of the ice bed and slopes of the river lines the shores with a facing of boulders—just as the ocean and the lakes heave up shingle and sand as barriers to their own further inroads on the land.

The direct action of the ice, in this climate, has more influence on the permanence of any artificial channel than this indirect action in staying the descent of detritus. Wherever large masses of ice are grounded upon a yielding substratum they act as temporary islands, diverting the course of the current, increasing its intensity, and concentrating its energy on the open spaces between the grounded bergs of ice. To this cause is to be attributed the "shifting of the channel" through sand bars on which the ice rests; but, notwithstanding the descent of those immense quantities of ice which "pack" and "ground" so as to alter the current during winter below Montreal, it is satisfactory to know that no difficulty is to be apprehended from such action of the ice in Lake St. Peter. The winter level of the lake is raised six feet and upwards, before it freezes over, by the accumulation of ice and the consequent obstruction made to the discharge of the river below the lake. The ice forms of even thickness, and as the depth near the channel is seldom less than eighteen or twenty feet, the winter current is consequently weaker than the summer one. The dredged channel through the lake occupies nearly a central position, both with respect to length and breadth; it is

therefore too far removed from the mouths of the lateral rivers flowing into the lake to receive their detritus; and as regards any deposits from so clear a stream as the St. Lawrence, these could only reach the excavated channel by the aid of such a current as would carry them on through the lake.

The oldest known charts shew that little change has taken place in Lake St. Peter, and from more than half a century's experience we may come to the conclusion that the maintenance of the artificial channel now in progress is not seriously threatened by the action of any natural causes. An examination of the old dredging done by the Board of Works in 1844, '45, '46, and '47, after a lapse of seven to ten years, shews that the ridges left between the "trench cuttings" are still well defined,—and no perceptible change either for better or worse is to be discovered in this part of the lake.

STRAIGHT AND NATURAL CHANNELS.

With respect to the question of the route for an artificial channel through Lake St. Peter, that may now be considered as settled; and, as there is now a navigable channel, two hundred and fifty and three hundred feet wide with sixteen and a-half feet depth at low water, over the flats, where there was formerly only eleven feet, the propriety of the route adopted by the Harbour Commissioners need not be vindicated. The recent determination, however, in favor of a twenty feet navigation, instead of one of sixteen feet, (which was the maximum where the question of the "straight" and "natural" route was concerned,) may fairly be claimed as one of the most important results of the decision in favor of the "old channel." To explain this it is necessary to refer to the history of the operations in the lake.

It will be remembered that in 1845 the Government commenced to dredge a straight channel about ten miles in length, from a point below Stone Island, (at the head of the Lake,) to the head of the lower pool heretofore described. This would have avoided both the Upper Bar and the Flats, and have shortened the route through the lake nearly one mile. After working until September, 1847, when £73,955 had been expended for outfit and operations; in removing what now appears to have been less than 350,000 cubic yards, measured in excavation, the scheme was abandon-

ed. In 1850, the two dredges were transferred to the Harbour Commissioners of Montreal, who commenced operations in the following year, in the "old," or "natural" channel, and up to 1st January, 1855, have dredged 1,818,110 cubic yards, measured in the scows, (or 1,298,650 cubic yards, measured in the cut,) and removed by harrow 85,436 cubic yards, at a total cost of £74,000 for operations and outfit, in which is included a sum of £10,000, as the value of the two dredges obtained from the Board of Works.

In the one case, four years of time and nearly £74,000 in money were expended without any practical result—the straight channel remaining now as when abandoned; in the other, each successive season since the commencement has increased the draught and tonnage of sea-going vessels arriving at Montreal. This difference in result is owing chiefly to better management, and to a superior system of dredging established by Captain Bell, Superintendent to the Harbour Commissioners; and in some measure to the adoption of the old channel, where by taking advantage of the existing pools of deep water a less length of dredging is required, and therefore an additional depth to the channel is sooner given.

Although the "straight channel" would have shortened the route through the lake, yet as it was wholly an artificial one there was a greater amount of work to be done in it. Captain Bayfield, in 1846, estimated the dredging in the straight channel, for a depth of only fourteen feet at low water, 260,000 cubic yards more than that required to produce the same result in the old channel. In extending the work, however, to a depth of twenty feet, the economy of the old channel is much more apparent. The number of cubic yards to be removed, in order to give three hundred feet in width with twenty feet water in the "straight" channel, is no less than 1,180,000 *more* than is required to produce the same result in the "old" channel; which, at 7½d. per cubic yard, (or one-half of Captain Bayfield's estimate,) makes a difference of £36,875 in favor of the route chosen by the Harbour Commissioners.

ANNUAL PROGRESS IN LAKE ST. PETER.

The Harbour Commissioners commenced operations on the 12th June, 1851, with one dredge and the harrow, and on the 3rd of

November, in same year, a channel seventy-five feet wide, two feet deep, and four miles in length, was cut through the highest part of the flats. On the 8th of November the ship *City of Manchester* was loaded down to *fourteen* feet—the depth on the flats then being *twelve* feet—and taken through the lake without slackening speed. Thus, in less than five months, *two feet* were added to the draught of sea-going vessels trading with Montreal. In the spring of 1852 the harrow was employed during high water, in May and June, upon the Upper Bar, the depth upon which was thereby increased about three feet, leaving a channel one hundred and fifty feet wide and fifteen feet deep at low water—or four feet deeper than the flats. The dredges worked on the flats from the latter part of May until the 16th of November, by which time they had widened the channel (from seventy-five) to one hundred and fifty feet, and deepened it (from two) to four feet. The length of the channel of 1851 was also increased (from four miles) to five and a-half miles—this additional length of dredging being required in consequence of the increased depth. Thus at the close of the second season, or in less than eleven months of actual work, a channel of one hundred and fifty feet in width, and four feet of additional depth, was cut through the flats and the Upper Bar, at a cost of £47,250 for operations and outfit (in which £10,000 is allowed for the dredges); or, in other words, a channel of the same width and one foot greater depth than that which the Government had failed to secure in the new route with a far greater expenditure of time and money. The Harbour Commissioners were notified in November, 1852, by the Superintendent, that he was then prepared to take a vessel through the lake drawing four feet more water than any which had hitherto left Montreal at that season of the year. Throughout the season of 1852 the sea-going vessels made use of the new channel, and many of them were loaded down two feet deeper than the water on the flats.

A vessel of sufficient capacity could not be obtained, (at that late season of the year,) to test the capacity of the channel in November, 1852, but this was done on the 24th of August, 1853, by the barque *California*, which was loaded down to sixteen feet two inches, when there was only twelve feet on the flats, and taken from Montreal through the lake without delay or difficulty.

At the close of the season of 1853 the channel of 1852 was deepened, throughout, one foot six inches, giving sixteen and a-half feet at low water; and a part of it was widened (from one hundred and fifty feet) to two hundred and fifty and three hundred feet.

The operations of 1854 in the lake have been confined to widening the channel, and there is now, with the exception of about ten days' work, a channel through the flats two hundred and fifty to three hundred feet wide, and having in it sixteen and a-half feet at low water. This has been effected at a total cost of £74,000 including £10,000 as the value of the two dredges obtained from the Board of Works. Thus, within the same period of time, and for the same sum of money as has been expended on an ineffectual attempt to obtain a channel *one hundred and fifty* feet wide, with *fourteen* feet water on the straight line, one of *two hundred and fifty* and three hundred feet in width, with *sixteen and a-half* feet at low water, has been given through the flats, and one of one hundred and fifty feet in width and fifteen feet water through the Upper Bar.

OBSTRUCTIONS ABOVE AND BELOW LAKE ST. PETER.

No subsequent testing of the channel, to that by the California in 1853, has since been made, for the following reasons:—

About thirty miles below Montreal, between Lavaltrie Island and Ile Platte, a broad shoal stretches across the river, consisting of blue clay covered with gravel and boulders. The original depth over this shoal, on the line of the channel, was the same as on the flats of Lake St. Peter, viz: eleven feet at low water.

While the dredges, obtained from the Board of Works, were employed in the lake, the harbour dredge was brought down from Montreal in 1851, and on the 18th August, 1852, she had cut a channel through this shoal two hundred and fifty feet wide and four feet deep. This dredge was then removed to a small bar opposite Ile deLorier, or St. Laurent, (a little below Varennes,) which she reduced to the same depth in that year. When the California was taken down, drawing four feet more water than usual, it was found that she "touched" at Point aux Trembles, Ile à la Bague, St. Sulpice and Lavaltrie Island, although the pilots maintained that she followed the deepest channel in the River. Before any additional advantage, therefore, could be gained for the trade by

increasing the depth in Lake St. Peter and at Ile Platte, it became necessary to ascertain the nature and extent of *all* the obstructions between these points and Montreal; and, particularly whether the channel known to the pilots, and defined by the river lights and beacons, was really the best that could be obtained.

It will be apparent that, so long as the flats of Lake St. Peter were the gauge of the draught of vessels ascending the St. Lawrence between Quebec and Montreal, no vessel drawing *more* than eleven feet at low water had ever navigated the river above the lake. The channel known to the pilots, therefore, had never been tested for any increased draught, and as soon as this was done, (in consequence of the deepening in the lake,) the pilots' channel became obsolete,—because their actual experience did not extend to a draught greater than eleven feet at low water.

On the 6th of September, 1853, I was requested to report the best means of dealing with the obstructions revealed by the "California" on her passage outward, in the preceding month; and, in reply, recommended an examination of the river, for the purpose of comparing the existing channel with others indicated on Bayfield's charts, and of ascertaining *what scale of navigation was within the reach of the Commission*, in case that, from the success of previous operation in the lake, it might prove desirable to continue these to a greater depth than originally proposed. This recommendation was adopted, and immediate steps were taken for carrying it out, so that the examination was completed, and on 25th of October I reported the result.

It was found that, between Varennes and Lavaltrie Island, and between Cap Madeleine, (below Three Rivers,) and Isle Bigot, the route lighted and marked by the pilots did not afford more than sixteen feet at low water, and was not in the main channel—or the deepest part of the St. Lawrence.

The obstructions at Pointe-aux-Trembles were found to be clay, and of trifling extent; but from Varennes to Lavaltrie, the north channel at present navigated is studded with numerous "*pouls*" caused by the loose rocks or boulders, having narrow channels with sharp turns between them, and exposed to cross current of the Ottawa, the greater part of the waters of which flow over into the south channel and pass by Verchères. The channel south of the Verchères Islands was then examined,

and found to have a depth of thirty to sixty feet, with the exception of one point opposite Cap St. Michel, where this channel appears to have been partly closed up by a land slide, which, together with the fact that the north channel has had hitherto sufficient water for any vessel which could pass Lake St. Peter, account for its disuse. The bank of Cap St. Michel was bored and found to be clay, much more easily removed than the "*pouls*" of the north channel. In every respect the south channel is superior to the north one; its greater depth giving less current, and its bold shore and high hanks making it more easy of navigation at night or in a fog.

Below Three Rivers the south channel, in front of Becancour, gives a depth of thirty to forty feet without any obstructions requiring more than lights, buoys, and beacons. By adopting this channel, the shifting sand bar, known as the "Provenché Shoal" will be avoided. This is of great importance, as this sand bar appears to have been formed by the River St. Maurice, and is still acted upon by it, making it doubtful whether a channel could be maintained, for a greater depth than heretofore used, without continual dredging. That the present ship channel over the shoal is not the channel of the St. Lawrence is evident from the fact that the dark waters of the St. Maurice are found in it unmixed with the blue water which flows by Becancour.

The only place below this where twenty feet draught can not be used at all times of tide is at Pointe à Levraut, (opposite Ste. Anne,) where the bar of blue clay before alluded to is found—insignificant in extent, and over which vessels can always pass, drawing twenty feet, by waiting for the tide.

MODE OF DREDGING.

On comparing the operations and expenditure of the Board of Works in the four seasons from 1844 to 1847 inclusive, with those of the Harbour Commissioners in the four seasons from 1851 to 1854, we cannot fail to be struck with the difference in the cost of dredging per cubic yard, as much as with the immediate and beneficial results to the trade, arising from the latter management. While much is no doubt to be ascribed to the selection of the old channel by the Harbour Commissioners, it cannot be doubted that the system of dredging established by Captain Bell, had it been

applied to the straight route, would have resulted in opening that channel to the trade long before the period at which it was abandoned by the Board of Works.

The importance of this system, as well as its bearing on future operations, is such as to call for a description of its advantages; while the fact that a greater amount of work has been done and a greater result produced in less time and at less cost by the Harbour Commissioners under Capt. Bell's system and superintendence than in any other dredging operations heretofore undertaken, makes it a subject of the highest interest to the profession, as well as to corporations or other public bodies or departments requiring a large amount of dredging to be done.

Under the old system, the dredge was moored to its work by two chains laid out forward in the direction of the channel to be excavated. In going ahead, a ditch was cut the width of the buckets, (and of a depth proportional to the hardness of the material,) as far as the length of the chains would permit; the buckets were then lifted, and the dredge dropped back to the place of beginning, when the process was repeated by cutting a similar and parallel trench until the proposed width of the channel was attained. Between these parallel trenches a ridge from one to two feet in width was left,—it being impossible to cut these trenches without leaving a ridge to sustain the “tumbler,” which otherwise would have carried the buckets out of cutting into water, bringing them up empty. After the channel had thus been “grooved” or “fluted” by the “trench cutting” system, the removal of the intermediate ridges was commenced. To steady the buckets upon the narrow space guys were employed, and in working ahead to feed the buckets the direction of these guys was necessarily altered whereby the dredge immediately lost her hold of the bottom. The bucket frame was then lifted, the vessel again steadied upon another ridge, and, after all, the bottom, instead of being uniform in depth, was left like the teeth of a saw. When it is remembered that these operations were carried on in a wide lake exposed to wind and sea, with a current of about one mile per hour, the great loss of time in raising and lowering the buckets, in “dropping back,” “guying out,” and “steadying” over the ridges, the cost of fuel, wages and provisions during the loss of time—the cost of these items for each dredge, with her

tender, being about £30 per diem,—and the utter impossibility of doing anything like true work under such circumstances, will be appreciated; nor can we resist the conclusion that, under such a system, with any appropriation which Parliament would sanction, failure was inevitable where a channel ten miles in length and three hundred feet in width, with sixteen feet at low water, was attempted.

When making a survey of the lake upon the ice, in March, 1854, I caused to be measured and sounded the channel excavated by the Board of Works, taking cross sections at every five hundred feet. I annex a cross section at the bottom in this channel, taken in January of this year, and also one, (taken at the same time,) of the channel dredged by Captain Bell, by which the difference in execution of the two systems is strikingly illustrated. The condition of the Board of Works channel, after the lapse of seven years, is satisfactory so far as it indicates that little change has taken place, judging from the clearness with which the ridges are still defined, although from the great discrepancy in the measurement of the excavation done, as made in 1854 upon the ice, compared with the returns made after the suspension of the works in 1847 and 1848, would go to shew either a large error on one of the measurements, or an extensive “silting up” in this channel. I cannot learn that any measurement was made, on the suspension of this work in the manner since done by me, but have understood that the quantities supposed to have been removed were arrived at by calculations as to the contents of the buckets, scows, and the “average work” of the dredges.

I find the quantity removed in the Board of Works channel to be 332,044 cubic yards, instead of 734,945 cubic yards, which is the sum of the two returns in the reports of the Commissioners of Public Works in 1847 and 1848. The difference may, in some measure, be accounted for by the assumed length of dredging, as determined by the buoys and a nautical survey, proving considerably more than the actual length as measured on the ice. I found that the distance across the flats, between known points in the old channel, measured half a mile less, (in a distance of six and a-half miles,) on the ice than on the charts. A similar miscalculation may have been made in estimating the Board of Works channel; but this would only account for a portion of the discre-

pancy. If we deduct the whole of the outfit, (making no change for depreciation,) it would still appear that about £33,500 were expended "in operations" in the new channel. Taking the present measurement of 332,044 cubic yards, and setting off any work done in piling groins, &c., against the depreciation of outfit, the actual cost of that dredging, measured in the cut, cannot be set down at less than two shillings currency per cubic yard.

To have secured a channel on the "straight line," of the same dimensions and of the same water as that which has now been made by the Harbour Commissioners on the old route, would have required the removal of 1,750,000 cubic yards, in addition to the 332,044 removed, which, at the same rate of cost, (two shillings per cubic yard,) would have amounted to £175,000, making the total cost of the new or straight channel £249,000 against £74,000, the actual cost including outfit, of an equally efficient channel upon the old route.

But, inasmuch as the amount of excavation in the new channel would exceed that required in the old, (for the three hundred feet in width and sixteen and a-half feet in depth of water,) by about 750,000 cubic yards, if the cost of this amount be deducted, the figures would stand £174,000 against £74,000, as the cost of an equal amount of work in the two channels. If, as appears from present measurements, 2s. per cubic yard was the actual cost in the straight channel, the difference of £100,000 is the measure of the amount of economy in favor of the improved system of dredging adopted in the old channel, which system I now proceed to describe.

The system employed by Captain Bell, on assuming the charge of operations in the lake, is that known as "radius cutting," as distinguished from the ordinary or "trench cutting," method. The dredge is moored on chains leading from the bow and stern in the direction of the channel, and also by four chains at right angles to the channel, one out from each quarter of the vessel. In this position, she may be compared to a *turtle*, chained by the head, tail, and the four legs, and floating over the channel to be cut. Instead of cutting a continuous trench, by hauling ahead on the bow chain, the buckets take a feed of two or three feet, after which this chain remains "taut," and the dredge is breasted over, by means of the side chains, broadside on, from one

side of the channel to the other, the buckets crossing the whole width of a channel of 150 feet, and leaving the bottom true and even. When the opposite side of the channel is reached she is heaved forward for another feed, and recrosses the channel in the same manner, cutting from left to right and from right to left alternately. Her bucket frame, sweeping across the channel, acts as a huge plane with revolving cutters; thus, from the very nature of the system, there is a guarantee that when she has once gone over the ground no obstruction above the level to which the buckets were lowered *can* have been left behind. The four side winches are worked by the engine. The adaptation of the old Board of Works dredges to this mode of working is due to Captain Bell, and to this arrangement chiefly I attribute the great advance made in dredging. I am not aware of any similarly efficient gearing in use elsewhere.

In the "trench cutting" method, it is necessary to heave ahead on the bow chain in order to feed the buckets while the latter are cutting. This strain is avoided in the "radius cutting" plan, where the bow chain is only wound up when the dredge has crossed the channel, and remains of the same length while the buckets are cutting. Again, the irregularity of the working of the buckets, when removing the ridges in the trench cutting system, was productive of greater wear and tear on the machinery than occur in the improved method where they are constantly in full work.

COST OF DREDGING.

In order to estimate the cost of the dredging, accurate surveys were made on the ice early in 1854, and soundings were taken at Pointe aux Trembles, Cap St. Michel and Lavaltrie, as well as in Lake St. Peter, by which the quantities to be removed for successive draughts of water have been calculated; the estimate is appended to this report.

I have analysed the cost of dredging in Lake St. Peter, from which it will be seen that the cost per cubic yard, *measured in the scows*, for raising and depositing at the distance of half a mile, is under five pence. This price excludes the cost of outfit, which for work already done has amounted to £18,000. The cost of new outfit for the 20 feet draught will amount to about £19,000. As

this machinery is available for many years' work, it is only the depreciation which is needed to shew the whole cost of dredging. If, however, we assumed that the present outfit, (the charge for repairs being embraced in the above annual cost of dredging,) will be annihilated on the completion of the work, that is, when about 6,000,000 cubic yards measured in the scows have been dredged, the charge per cubic yard, on account of this outfit, would be under three half-pence per cubic yard. As, however, one of the dredges embraced in the above calculation is perfectly new and has not yet commenced work, and both the others are being lengthened and straightened, there is every reason to believe that the dredging fleet, on the completion of the channel three years hence, will be in a thoroughly efficient state. I consider, therefore, that an allowance of *one penny per cubic yard* will be at least a sufficient charge for the depreciation of the outfit, which, added to the average of $4\frac{1}{2}$ d., makes the total cost of dredging $5\frac{1}{2}$ d. per cubic yard, measured in the scow. If an allowance of forty per cent. be made for the difference between the measurement in the scows and that in the cutting, which allowance I find to be ample, the highest cost of raising and depositing (at a distance of half a mile) a cubic yard of solid excavation will be about $7\frac{1}{2}$ d.,—a price lower than the same could be done, under the most favorable circumstances on dry land, and far below the cost of dredging and depositing under such circumstances on any work known to me. No account has been taken of the interest on loans for carrying on the work, which interest is paid out of revenue; an addition of three half-pence per cubic yard, upon the quantities already dredged, covers this item,—making the whole cost $9\frac{1}{2}$ d. per c. yard measured in excavation.

It must be admitted that the material is as favorable for dredging as it possibly could be, and the one circumstance most conducive to economy is that the buckets are always in full work. On the other hand, the working season is short, the price of coal is high, and there has been much detention from the wind and high water. In order to show the actual working time and the delays from every source, I have prepared tables taken from the Superintendent's books which shew the extent of daily interruption and explain the cause of it.

The investigation and analyses exhibited in the tables are pre-

sented for the purpose of sustaining the estimate I have made of the probable cost of completing the channel through the lake. The principal item which influences the cost, and in which any important fluctuation may be expected, is the price of coals. In this, as well as the items of labor, provisions, &c., I have provided for the extreme high rates of 1854, which are not likely to be exceeded, and from which some diminution may reasonably be expected. It will be seen that the actual cost of dredging in 1854 was $4\frac{1}{2}$ d. per cubic yard, measured in the scows, and as the quantity remaining to be removed is measured "in excavation" and not "in spoil," I assume $7\frac{1}{2}$ d. per cubic yard as a fair estimate of the probable cost, exclusive of interest, depreciation, or outfit.

In January and February, 1854, I measured "in excavation" the whole amount of dredging done by Captain Bell, and found it to amount to 815,000 cubic yards, at a total cost of £22,000, or about six pence half-penny per cubic yard, exclusive of outfit, interest, or depreciation. The return by scows up to this time was as follows :—

In 1851 from 10th July to 14th November, 1 dredge filled	1124½	scows.
1852 " 22nd May to 15th "	2	" " 7159 "
1853 " 21st May to 23rd "	2	" " 7943 "

giving a total of $16,226\frac{1}{2}$ scows, at seventy cubic yards per scow, equal to 1,135,855 cubic yards.

The return by scows of 1,135,855 cubic yards, as corresponding with the measurement of 815,000 cubic yards of solid contents, missing from the channel, shews that the excess of the measurement "in spoil" is forty per cent., or that fifty yards "in excavation" will measure seventy yards in the scows.

The number of scows filled in 1854 was 9663, equal to 676,410 cubic yards, making the total quantity dredged to close of 1854, 1,812,265 cubic yards measured in scows, or 1,294,475 cubic yards measured in excavation, and if to this be added 85,436, the amount removed by harrow, we have a total of 1,379,911 cubic yards measured in excavation, removed for an outlay of £74,000, (including the full value of outfit), or nearly thirteen pence per cubic yard. The cost exclusive of outfit is £42,300, or about seven pence per cubic yard.

A similar measurement and calculation, applied to the straight

or Board of Works channel, show the present result of the operations there to have been attained at a cost per cubic yard *four times greater* than that in the old.

In the four full months of 1854, July, August, September and October, the two dredges averaged twenty-five working days each month, and filled 7,523 scows, (raising together seventy-five scow loads daily,) which, at seventy cubic yards per scow, gives 526,610 cubic yards in one hundred days, or 6,266 cubic yards per diem. In 1846 the daily work of these same dredges in the "straight" channel was reported as "most satisfactory," when removing on the average 2321 cubic yards per diem. In the last year of operations in the straight channel the work of the dredges was considerably improved, and they were reported averaging together forty-four scow loads, or about 3000 cubic yards, daily.

In order to show the remarkable superiority of the foregoing performance of dredges working on the radius cutting principle, I give some data of the ordinary method furnished by a friend in Plymouth, England:—

"A forty horse-power-dredge at Holyhead, (with a "double set" of buckets,) working in thirty-five feet of water, raised one hundred and ten tons in forty minutes. A Government dredge of thirty horse power, now working here, is said to raise ninety tons of mud per hour—a depth of water from four to twenty feet. This machine was built at Southampton.

"Another, belonging to a contractor, has been working here for three years; it is called a thirty-horse-power, (cylinder two feet six inches, stroke three feet six inches), and has raised sixty tons of mud per hour, but its average work in that material, during three hours, has been only 2000 tons per week.

"One of the Clyde dredges, (sixteen horse power, cost £2800,) raised in twelve hours 160 tons of hard clay.

180 " of gravel.

230 " of sand.

250 " of mud.

300 " of soft clay.

"It consumed in twelve hours one ton of coal, or eleven and three-quarter pounds per horse-power per hour. Twelve men worked the machine; fourteen the punts.

"A twenty-horse-power dredge, built at Newcastle, raised 2000 tons of mud per week, at a cost of 6d. per ton, (unloading "included)."

The Holyhead *double* dredge raised at the rate of one hundred and sixty-five tons per hour. The Clyde single dredge raised at the rate of twenty-five tons per hour. The other performances are under one hundred tons per hour. These may be considered the best work of the dredges quoted. The new forty-horse-power double machine, started in the Clyde in 1851, has raised for the last year, 106,848 cubic yards in 1822 hours working time—less than sixty yards, or about one hundred tons per hour.

The ordinary work of the dredges in Lake St. Peter is to raise two hundred and eighty-nine tons per hour, estimating the material dredged to weigh one hundred and twenty pounds per cubic foot, while the best work of these single dredges has been to raise four hundred tons per hour for the whole day; that is, they have filled fifty-six scows in ten hours, each scow containing seventy yards in spoil, or fifty of the solid deposit.

I have also prepared a statement shewing the number of vessels, their dimensions and crews, from which the magnitude of the operations may be estimated; and for the purpose of comparison, I give some statistics of dredging in the Clyde, where the largest operations of this kind have been carried on. From these it will be seen that a greater amount of work has been done in one year at a much less cost in Lake St. Peter than has been done in any one year in the Clyde, or elsewhere.

A table showing the fluctuations in the depth of water on the Flats of Lake St. Peter, for the last four years, is appended, for the purpose of showing the dates and duration of the period of low water.

SURVEY AND ESTIMATE.

I have already explained the more important objects of the exploration of the different channels, obstructions, &c., above and below Lake St. Peter, made in September and October, 1853, and the subsequent winter survey on the ice, in the lake and at points above it; but in vindication of the expenditure for such a step, I will here allude more fully to it.

When I assumed the office of Engineer to the Commission, we

were in possession of no other information with regard to our operations in the lake than was to be obtained from Bayfield's charts, and the annual reports of the Superintendent. In consequence probably of the failure of previous operations in the straight channel, there was some doubt thrown on the statements made as to the depth and width of the channel already dredged on the old route, and although I had satisfied myself of the correctness of the Superintendent's reports, yet, as the work extended over many miles of surface,—was all under water and not easily tested without considerable time and labor,—I consider it indispensable that there should be placed on record a chart shewing the *exact position* of the work done, as well as its extent. Moreover, without such a chart, none of the future changes which might arise out of our operations, could be traced and estimated; nor without an actual measurement of the excavation, as determined by the dimensions of the channel, could we establish the ratio of the measurement as computed from the number of scows filled, or ascertain the actual cost of the work done, so as to refer it to a standard by which the value of the work remaining to be done could be estimated. Thus, it is clear that the work remaining to be done must be measured "in excavation," while that already done had been measured in the scows; and as every hundred yards measured in the bottom makes about one hundred and forty yards when measured in the scows, 40 per cent. must be added to the price per cubic yard of that already dredged, (when measured in the scows,) in order to obtain the value of that remaining to be dredged. In all preceding measurements and reports referring to Lake St. Peter, I cannot find that this obvious distinction between the two modes of measurement has been taken into consideration, and this single circumstance alone may account for many of the discrepancies in the returns, and failures in the estimates for the straight or Board of Works channel.

Lastly, it is highly important, before the full width or depth was given to the proposed channel, to ascertain whether it was uniform in depth and width, and straight in its direction, in order that any necessary trimming or widening could be taken wholly off of one side, or both, as would prove requisite; and most especially was it desirable that the direction of this new channel should be accurately ascertained *with reference to the deep pools* with which

it communicated. The boundaries of these pools had hitherto been loosely defined by the few soundings to be found in Bayfield's charts, but for the purposes of a work of this magnitude, it was important that their contour should be fully developed, which has now been done in the most accurate manner by surveys and soundings on the ice; and the result shows the correctness of the alignment of the dredged channel with reference to the deep water above and below it.

The charts of the shoals at Pointe aux Trembles, Cap St. Michel and Lavaltrie, with the measurements and soundings made on the ice, shew the nature and extent of the dredging required. From the strength of the current at these places this result could not have been arrived at as certainly or as economically by means of boats.

The large chart of the St. Lawrence between Montreal and Quebec has been prepared for the purpose of enabling the public to see at a glance the general capacity of the channel, and to show that the attainment of a draught of twenty feet at low water is as practicable as it is desirable.

From the estimate annexed it will be seen that the cost of a channel three hundred feet wide, through all the obstructions met with between Montreal and Quebec, is estimated as follows:—

For a depth of 18 feet at low water,	£41,743	5	1
Additional for 19 feet " " "	21,907	19	0
" " 20 feet " " "	25,009	5	3
Total,	£88,660	0	0

Or say £90,000, including the bar at Pointe Levrault, &c., and adding expenditure already made by the commission, (including £19,000 for new outfit for the twenty feet line,) at £93,000 we have a total of £183,000 as the cost of adding *nine* feet to the draught of vessels coming to Montreal. Of this expenditure £40,000 is for outfit, which will be in good order on the completion of the work.

However large these figures may appear, the sum in my judgment bears no proportion to the magnitude of the object to be attained.

CLYDE NAVIGATION.

As the best introduction to the commercial bearing of the deepening of the channel of the St. Lawrence between Montreal and Quebec, I give a short statement of what has been done in the Clyde.

One hundred years since, vessels drawing three feet three inches to three feet six inches only, could ascend the Clyde to Glasgow. In 1773 certain improvements were commenced, for the purpose of assisting the action of the tide, and, in 1806, vessels drawing eight feet six inches could ascend to Glasgow. In 1824, when the first steam dredge (No. 1*) commenced work, the depth had been increased to eleven feet. The second dredge was started in 1826, a third in 1830, a fourth in 1836, a fifth in 1841; and in 1850 a depth of seventeen and a half feet at neap tides had been gained. The value of the working machinery for the improvement of the Clyde was estimated at £39,000 sterling, in 1845, since when, an additional sum of about £18,000 has been expended in new plant. The total expenditure for the river and harbour, by the Clyde Trustees, within the last hundred years, has been about £2,000,000 sterling.

In deepening the Clyde, about 6,000,000 cubic yards have been removed, 2,000,000 of which were previous to the commencement of the dredges in 1824, chiefly by the scour of the tide, aided by dykes and jetties. Of the remaining 4,000,000, about 3,500,000 have been removed since 1840, at an average cost of about thirteen pence sterling per cubic yard. The annual expenditure for dredging, since 1840, average about £15,000 sterling—the sum of £212,537 sterling having been expended for this purpose since that date.

The depth secured is twelve feet at low and eighteen feet at high water, and the width of the excavated channel in the narrowest parts is less than one hundred feet. To preserve this depth, an annual dredging of 160,000 to 180,000 cubic yards, and an outlay of about £8000 stg., per annum for dredging and repairs are required on a river eighteen miles in length. A single bank near Bowling accumulates so rapidly that it has cost £1200 a-year to

* In 1851 a new double dredge of forty-horse-power was substituted for No. 1.

keep it down. The cuts through the several banks are three hundred feet wide—the same width as proposed in Lake St. Peter. The “plant” consists of five dredges, aggregate power one hundred and sixteen horses, one eighty horse power tug, (iron), two hundred and sixty-two punts, forty boats, a diving bell, and thirty-four buoys with screw moorings.

The financial and legislative history of the Clyde navigation is not less interesting.

In 1758 the first Act was obtained for improving the river upon Smeaton’s plan. A lock was to be built, with a dam across the channel at Marlinford, (four miles below Glasgow,) by means of which four and a-half feet depth of water was to be secured to the harbour. Fortunately, this plan was not carried out, and in 1768 Mr. Golborne recommended the plan of jetties, &c., to assist the action of the tide. In 1770 an Act was got to deepen the whole stretch of the river, from Dumbarton up to Glasgow, to a depth of seven feet at neap tides. Powers were given in this Act *to levy dues upon shipping* to be applied towards improving the river, and in the same year a revenue of £147 sterling was drawn. In 1771 the revenue amounted to £1071 sterling.

In 1809 an Act was got to deepen to nine feet at neap tides, and *to borrow £30,000 on the credit of the trust*. Previous to this, the monies necessary to carry on the work had been advanced by the Town of Glasgow, but at this time had all been repaid out of the trust revenues. In 1824, when the first steam dredging machine was set at work, the river had been deepened to eleven and a half feet, the revenues had reached £8500, the size of the ships was increasing, and Glasgow owned one hundred and eleven vessels, amounting to 14,000 tons. In 1825 a fourth Act was got for deepening to thirteen feet at neap tides, and in fifteen years therefrom vessels of three hundred and four hundred tons, drawing twelve and thirteen feet water, were numerous in the harbour, although they could not pass the river in neap tides. The number of vessels had increased threefold, their tonnage fivefold, and the revenues had increased fivefold, amounting to upwards of £40,000 per annum. In 1840, therefore, an Act was obtained defining bold lines of river and harbour improvement, and for deepening to seventeen feet at neap tides.

In 1846 an Act was obtained for increased harbour accommo-

dition ; the number of vessels belonging to the port then amounted to 512, and their tonnage to 134,603 tons. The trust revenues had risen to £51,198 sterling ; the total amount drawn since 1770 being £906,554 sterling, and the total expenditure £1,253,951 sterling.

In 1850 the revenues amounted to £64,000 sterling. The customs of the port of Glasgow have risen from £3000, in 1811, to £640,000 in 1850.

It has been remarked that, under the first Act obtained for the improvement of the Clyde, (that is, for the construction of the lock and dam upon Smeaton's plan,) no dues were to be levied until after the works were completed, thus requiring a heavy outlay of capital before any return could be made—conditions which placed the work in a position similar to that held by our railways. The second Act however, which authorizes the levying of dues on ships, created an immediate fund, and the primary cause of the *financial* success of the Clyde improvements is ascribed to the system of removing ford after ford, and gradually deepening the channel as the revenues increased.

The revenues of the Clyde Trust for the year ending 1st July, 1854, were:

From Tonnage dues, £50,772	4	3
“ Quay “ 11,582	1	4
“ Shed “ 8,798	0	6
“ Crane “ 923	11	2
“ Weighing “ 1,943	10	11
	£74,019	8 2
And from miscellaneous sources.....	12,560	17 9
Making a total of.....	£86,580	5 11

The progressive gross revenues since 1850 have been :

In 1850,.....	£64,243
“ 1851,.....	68,875
“ 1852,.....	76,077
“ 1853,.....	77,919
“ 1854,.....	86,580

The gross receipts since 1842 have been £774,703 ; the expen-

diture in the same period has been £1,422,438, of which the following are items :

Interest on Loans.....	£270,823
Land for enlargement of Harbour.....	349,685
“ “ widening of River.....	100,798
Construction of works in Harbour.....	222,517
“ “ “ “ River.....	33,895
Dredging in River and Harbour.....	126,012

The debt has increased from £219,119, in 1842, to £811,480, in 1854, the interest on which is £29,742. The surplus revenue of

1851 was.....	£17,754
1852 “	19,065
1853 “	19,899
1854 “	21,623

I have quoted at this length from the history of the Clyde improvement, because there is a manifest analogy in the position and action of Glasgow and Montreal. Mr. Walker, C. E., reporting to the Clyde Trustees in 1852, says :—“ Mr. Ormiston states that ‘ many of the Glasgow outward bound ships load at Glasgow to about 15 feet 6 inches, and either call at Greenock, or anchor at the Tail of the Bank, where they load up to about 18 feet ; seldom, if ever, above 19 feet.’ ”

That “ the lighter ships have (with the exception of the very largest,) nearly all left Greenock and Port Glasgow, and have come up to Glasgow,” and “ that although Greenock has fewer vessels, the tonnage of these is greater. Vessels drawing 22 feet are common enough, and 2 feet more is not extraordinary.” “ This,” he observes, “ shows that all vessels come up to Glasgow, which possibly can, and the larger ones might reasonably be expected to follow, if encouragement were given them, as Greenock and Port Glasgow are, after all, only the deep sea port of Glasgow.”

IMPORTANCE OF THE WORK.

It may be argued that there is little comparison between the population and commerce of Montreal and Glasgow ; and it may be doubted whether the Clyde improvements have made Glasgow, or Glasgow the commerce of the Clyde ; yet it is evident that

the one cannot exist now without the other, and also that Montreal is in a much better position than Glasgow was when the Clyde improvements were commenced. In the trade of the St. Lawrence and its great lakes we have a future most promising, and a commerce within our own reach which must be as far before that of the Clyde as the area of the valley of the one river exceeds that of the other.

The commerce of the lakes *west of Buffalo* is now estimated at \$200,000,000, of the Mississippi \$150,000,000, and the steam commerce of the Ohio at \$80,000,000. The Mississippi and Ohio are connected with the lakes by canals and numerous railways, made and making, the yearly tendency of which is to draw up commerce from the Lower Mississippi to the St. Lawrence, giving this commerce an outlet to the Atlantic States and the seaboard, via Buffalo, Oswego and Ogdensburgh, in preference to the natural route via New Orleans. Moreover the propeller is rapidly taking the place of the sailing vessel, and (the St. Lawrence being open to the American trade) the day cannot be far distant when Montreal will become an entrepôt, during the season of navigation, for that trade which is rapidly overgrowing the capacity of the enlarged Erie Canal and of all the railways which debouche on the Atlantic—from Portland to the Capes of Virginia. The lake propeller will then meet the ocean screw steamer at the head of ship navigation on the St. Lawrence—wherever that may be. This point must either be Quebec or Montreal, and it may be supposed that it is a matter of indifference to the Province at large which becomes the favoured locality, and that therefore the deepening of the St. Lawrence between these two cities is a local or Montreal question. This consideration appears to have influenced the Legislature, in 1847, in abandoning the Provincial attempt to deepen Lake St. Peter. The subsequent granting, however, of powers to levy dues *upon the trade of the St. Lawrence* for this purpose was an acknowledgment of the Provincial importance of the work, and it may not be out of place here to endeavour to show how Canada is interested in extending her deep seaport one hundred and fifty miles further into the interior. This involves the consideration of the problem, “where can the sea and inland trade of the St. Lawrence most economically meet? whether should the lake propeller (the

smaller craft) descend to the lowest possible point to meet the Atlantic ship, or whether the latter (the larger vessel) should ascend to the highest possible point?

If we were considering only the *through* traffic, it would become simply a question whether three or four lake craft could make the additional voyage from Montreal to Quebec cheaper and quicker than one ocean vessel could ascend the additional distance between Quebec and Montreal; and *the relative facilities for transshipment at the two ports*. But, practically, the ocean vessel may wish to discharge part of her cargo at Quebec, and a still greater portion for local consumption or distribution by railways at Montreal, the remainder only being in transitu for more western ports. If it be assumed that the delivery to the railways could be done at Point Levi instead of at Montreal, there would be only the Montreal goods subjected to an extra transshipment, and the additional cost of railway—over water-borne—transport between Quebec and Montreal on the railway delivery.

There are, however, two local considerations which affect the general question, which are of much importance and, in my judgment, conclusive as to the superior advantages under which the Provincial import trade can be carried on through Montreal as compared with Quebec; and where the imports are landed, the exports can be most advantageously shipped, excepting of course the timber trade and its peculiar requirements.

The ocean trade is limited to a certain number of voyages which may be made between May and November, and the number of these long voyages cannot be influenced by the comparatively trifling addition of the ascent to Montreal. It may be assumed, therefore, that the same number of ships will do the same business whether they come to Montreal or stop at Quebec, but this cannot be said of the inland voyage. A greater number of inland craft, therefore, will be required to bring down the same amount of produce per annum, if taken to Quebec than if left at Montreal.

Practically, when lighterage is avoided, the same rate of freight may be expected to obtain between Montreal and European ports as for Quebec, and thus Canada West is brought virtually 160 miles nearer the Atlantic: and Lake Erie has a seaport, on her own waters, at least one hundred miles nearer than New York.

The second consideration is the relative advantages of Quebec and Montreal for the particular trade now enjoyed by each.

The all important advantage of a high tide will ever give Quebec the preference as the timber shipping port. This trade can be best accommodated by vessels anchoring in the stream, their cargo being floated to them by every tide, while the broad beaches laid dry by every ebb, serve as dressing ground on which the timber is prepared for shipment. The great demand for space for such a peculiar traffic will make coves more profitable than wharves; and without expensive docks a large commercial business cannot be carried on to the same advantage as in the undisturbed level of the tideless harbour of Montreal.

From Captain Bell's report it will be seen that a depth of sixteen and a-half feet throughout may be obtained for vessels ascending to Montreal, in September, 1855, and one of eighteen feet in the same month of 1856, provided the south channels at Becancour and Verchères are lighted and buoyed.

The completion of the channel to a depth of twenty feet *may* be effected in 1857, but need not be delayed beyond the summer of 1858.

To Captain Bell's report with respect to lights and buoys, I have nothing to add. On the completion of the deep channel permanent instead of floating lights will probably be established in the lake.

The requirements in the harbour of Montreal, I propose to make the subject of a separate report so soon as the plans for the same are matured.

I have the honor to be,

Sir

Your obedient servant,

THOS. C. KEEFER,
Eng. Harbour Com.

The work of deepening the channel was continued by the Harbour Commissioners, and in the report of Messrs. McAlpine and Kirkwood, dated 24th March, 1858, we find it stated that "the channel of the St. Lawrence has been deepened, so that sea-going vessels drawing 18 feet

at the lowest stage of water come up the river as high as Montreal." The following extract from this report contains items of interest with regard to the ship channel and the St. Lawrence route:—

Letter of Instructions to the Board of Engineers for the purpose of considering on increased accommodation in the Harbour of Montreal.

HARBOUR COMMISSIONERS' OFFICE,
Montreal, 9th Nov., 1857.

GENTLEMEN, — In order to obtain the fullest benefit from your advice on the important question submitted to you as to the best means of providing additional harbour accommodation at this port, and, to give a direction to your investigations, the Harbour Commissioners would call your attention to the following points:—

1. As a preliminary, — Have the Commissioners, in your opinion, acted wisely in deepening Lake St. Peter, and otherwise improving the navigation between Montreal and Quebec. Or whether would it have been more advantageous to the trade and commerce of the Province not to have deepened Lake St. Peter, but to have allowed the interior vessel to proceed to Quebec, and there exchange cargoes with the ocean vessel? Should you be of opinion, on examination, that no adequate public advantage has resulted, or is likely to result, from improving the navigation below Montreal, so that vessels from sea drawing 20 feet may ascend at the lowest stage of water to this port, it will then be a matter for your consideration and report, whether more extensive harbour accommodation should be made at this point, or whether the necessary facilities should be provided at Quebec for the general trade of the interior.

2.. The Commissioners have prosecuted the improvement of the navigation below Montreal, under the conviction that if a sailing vessel of 2000 or a steamer of 3000 tons could ascend from sea to this port without the necessity of lighterage, there to meet, at the foot of canal and inland navigation, the sailing or steam vessel of the interior, specially adapted to river and lake navigation, the cost of transport on imports and exports would thereby be reduced to a lower rate than if such inland vessels proceeded below this port, on a route which (by a comparatively

small outlay) could be made available for the largest class of ocean steamers and sailing vessels. Your opinion on this point is requested.

3. Another consideration will present itself for your opinion before advising the Commissioners to proceed with any extensive improvements, namely, the magnitude of the trade of the interior and of the West, and whether it is possible to attract any large share of it to this port. The Commissioners desire to direct your attention to the fact, that although the magnificent canals on the St. Lawrence are in perfect order, and have been in operation since 1849, with a system of railways also in operation for two years, running from Quebec, and connecting with all points south and west, yet, up to the close of 1856, the St. Lawrence route had only succeeded in attracting fifteen per cent. of the Western Canadian and Western United States trade, eighty-five per cent. of that trade passing through the Erie Canal and over the railways of the State of New York. Should you, upon examination, find that with the improvements now going forward on the Erie Canal, the route from the West *via* Buffalo and Oswego is likely to continue to be the best and cheapest to the Eastern States, New York, and Europe, then this opinion must guide you as to the extent of the works which you would propose for further harbour accommodation.

4. The Harbour Commissioners have been of opinion that the St. Lawrence route, as a means of transport between Europe, the Eastern States, Western Canada, and the Western States, has not yet been fully developed; that if the Welland Canal were enlarged, so as to admit the passage of vessels of 800 tons, and a canal constructed to connect the St. Lawrence with Lake Champlain, and suitable facilities created in this port, so as to shorten the stay of the western and ocean vessel, and thus reduce the cost of insurance, storage, and price of handling property, to the lowest possible rates, — a vast increase of trade would thereby be attracted to the St. Lawrence, to the great advantage not only of this port, but to the general public interests. It will be found that a vessel from sea in the port of Montreal is 120 miles nearer to the ports on the lakes than are any of the seaports on this continent; while the distance from Chicago, or from any other lake port, to Liverpool is 480 miles less *via* Montreal than *via* the port of New York. To these points your attention is directed.

5. Should your investigations as to the merits of the several channels of trade between the Atlantic and the interior, result in your finding that the port of Montreal possesses superior advantages as a depôt for the transfer of cargo between the ocean and the upper lake vessel, and that the St. Lawrence route may be made the cheapest to Great Britain and to other European countries, and also the best route to the Eastern States and to New York, then a large increase of harbour accommodation becomes imperative, and the nature and site for the improvements in the harbour will come next in order for your consideration and report, together with an estimate of the probable cost thereof.

6. On the question of site there has been much public discussion. It has been urged by some, that the improvements should be made in or near Hochelaga Bay; by others that docks could be constructed with advantage to the public at or near Viger Square; by others that a dock could be made by enclosing the present harbour; while another party recommends that the space between Windmill Point and Point St. Charles should be enclosed. On no one of these schemes have the Harbour Commissioners any opinion to offer. They desire to leave you at full liberty thoroughly to investigate and report on what seems to you best calculated to promote the general trade of the Province, believing that the true interests of this port will thereby be best secured.

7. The Commissioners would refer you to plans, prepared under their directions by their Engineer, Mr. Forsyth, showing the proposed improvements in Hochelaga Bay and at Point St. Charles; as well as to a report by their Chairman, Mr. Young, dated 23rd April, 1857, on the same subject; and also to a collection of various communications, which from time to time have appeared in the public prints in favor of particular localities as sites for such improvements.

Should any further information be required by you, the Commissioners will be ready to furnish the same, so far as they may have it in their power to do so.

JOHN YOUNG, *Chairman.*

ALEX. CLERK, *Secretary.*

To JOHN CHILDE, W. J. McALPINE, JAS. P. KIRKWOOD,	}	Esquires, Engineers.
---	---	----------------------

CHICAGO, March 24th, 1858.

HON. JOHN YOUNG,

Chairman of the Board of Harbour Commissioners of Montreal.

SIR,—Under your letter of instructions of the 9th of November last (*a a*), the undersigned, together with their late associate, Capt. John Childe, met at Montreal on the 9th day of November last, and proceeded to examine the several sites proposed for an extension of the harbour, and also of the works which have been in progress under direction of the Harbour Commissioners during the last four years for the improvement of the channel of the St. Lawrence below Montreal.

They also examined the river between Montreal and Quebec, and the system of lights and buoys which have been placed there by the Trinity Board and Harbour Commissioners of Montreal.

After making these personal examinations, and discussing the various subjects to which their attention was called by your letter of instructions, and deciding upon the general outline of the report, the preparation of its different portions was allotted to each of the members of the Board.

An arduous portion of the examination was undertaken by Captain Childe, and was prosecuted with his usual zeal and earnestness until his last fatal illness.

The compilation of the labors of the other members of the Commission, and the final arrangement of the report, was also assumed by Captain Childe; but his lamented death, in February last, prevented the completion of either of these duties.

His family have placed in our hands the voluminous notes and memoranda which he had with great industry prepared and collected; and we have incorporated his opinions, both written and verbal, as far as it was possible, in the following report.

The undersigned have felt it necessary to make these explanations in apology for the delay in the final completion of the report.

The result of their investigations on the several subjects stated in your letter of instructions are given, but not in all cases in the order mentioned.

In connection with this report, they present various communications which they have received from mercantile gentlemen,

(*a a*) See Appendix, note A A.

and from the Trinity Board of Quebec, on several subjects which they have had under consideration.

They also present the estimates and plans of the proposed harbour at Montreal, prepared by your Engineer, Mr. Forsyth.

We take pleasure in alluding to the professional skill and ability displayed by Mr. Forsyth in the preparation of these plans and estimates, and in his courtesy in furnishing us with every aid in his power to enable us to examine and readily understand the plans and projects brought before us.

Respectfully submitted,

WM. J. McALPINE,
JAMES P. KIRKWOOD.

Extracts from the report of Messrs. McAlpine and Kirkwood.

*** The channel of the St. Lawrence has been deepened so that sea-going vessels drawing eighteen feet at the lowest stage of water come up the river as high as Montreal, and operations are now in progress by which a channel of twenty feet will be given. ***

Having brought the cost of transport from the interior to Montreal, the next point for consideration is as to the expediency of continuing the lake vessel to Quebec, or of bringing the sea-going vessel to Montreal. Our late associate, Mr. Child, had fully examined this question, and we quote from his notes as follow:—

It has been already shown that the shortest and cheapest route from Chicago to tide-water is *via* the St. Lawrence, and it is admitted by all commercial men that unobstructed transport trade will always take the shortest and cheapest route. As a question of practical economy, it must also be admitted, without the necessity of argument, that vessels properly constructed for the lake and river traffic west of Montreal, will be neither safe nor profitable for the gulf and ocean; nor, on the other hand, would the deeper build of sea-going vessels be suitable for the canals and shallow parts of the river and lakes. It follows, then, that a port of transshipment must be provided. The natural course of Canadian trade and population has from an early period made Quebec and Montreal prominent centres of both upon the river. These cities divide the river trade, and are together capable of affording all the facilities that the future commerce of the river may require. The differences peculiar to each seem to

spring solely from natural causes, to wit: at Quebec the river harbour is deep and broad, the channel from thence to the ocean has always been unobstructed and sufficient for the largest class of vessels. The changes of tidal level (13 and 18 feet respectively for summer and spring) would be detrimental to general traffic, but are of very great advantage in the landing, preparation, and shipment of timber, which is chiefly transported in rafts from the upper country to Quebec. For such reasons the immense timber and lumber trade of the provinces will doubtless continue to be transacted at Quebec.

Quebec and Montreal must enjoy a very large increase of general traffic by the increase of population in their respective districts, and also by all public works which serve to expedite and cheapen the collection, transportation, and distribution of produce and merchandise whether inward or outward bound *via* the St. Lawrence route.

It is apparent that the position of Montreal, at the head of ocean navigation and at the foot of the lowest rapids, possesses certain advantages peculiar to itself. It is surrounded by a more populous and fertile region of country, at the confluence of the St. Lawrence, Ottawa, and Lake Champlain routes of trade, and the focus towards which the continuous influences of railways and the natural and artificial water-channels of the West and Northwest will more and more concentrate the trade of the lake countries. These countries now number eight millions of people: at the close of another century they will probably come up to twenty millions.

We notice also, as a proof of the eligible commercial position of Montreal, that in the years preceding 1856, during which the corn laws of England and all differential duties favoring the direct export and import trade with the Canadas had been repealed, and the bonding system of the United States and the reciprocity treaty with that country established, the ports of the United States became virtually *free* to Canadian trade, thereby diverting from the St. Lawrence route $\frac{1}{3}$ of the Canadian cereal exports and $\frac{1}{3}$ of all imports. Yet the imports into Montreal increased at the same time fifty per cent, but $\frac{1}{3}$ of this increase appears to have accrued on the first year of the reciprocity trade with the United States.

In 1855 the total imports by the river are stated at.....	\$11,494,028
Total imports from United States ports.....	20,825,432

Making total imports..... \$32,319,460
of which Montreal absorbed \$12,372,580, or over $\frac{3}{8}$ of the whole;
and \$878,552 more than the total imports that year by the river.

Thus showing Montreal to be largely on the increase, notwithstanding the diversion of the trade from the river to other routes, via Portland, Boston, and New York. (b)

But the true interests of Canada, and of the North-western Lake States, requires that that trade and its future increase shall be restored to the shorter and cheaper route *via* the St. Lawrence, not by restrictive governmental enactments, but by perfected canals, deepened channels, numerous light-houses and well instructed pilots.

Other local considerations point to Montreal as the sea-port of the West, and as the proper point of transshipment between sea-going and interior lake vessels.

1st. Because the larger sea-going vessels can continue their voyage from Quebec to Montreal, one hundred and eighty miles, at less cost per ton than would attend running the smaller interior vessels from Montreal to Quebec; for with the completed twenty feet channel and corresponding harbour extension at Montreal, there is no reason to apprehend extra risk or detention.

For instance, a steamer of medium size arrives at Quebec fully loaded with 1200 tons of goods, 250 for Quebec and 950 for Montreal and the West, with an average of 100 passengers. After discharging the Quebec freights, her actual expenses to Montreal and back will be as follows, exclusive of lake dues, which ought to be rescinded on the completion of the new channel, if not before:

Pilotage up and down.....	\$107
Wharfage at Montreal 12 days.....	100
Coals consumed, average 70 tons (\$280).....	280
Sums expended in running up and down and mooring at wharves two days, for which the pay and subsistence of officers and men will be.....	140
Interest and insurance (2 days) on cost of ship.....	128
Total disbursements Quebec to Montreal and back...	775
Add contingent expenses.....	75
	<hr/> \$830

(b) See Appendix, note B.

If we count each passenger as equal in rate and measurement to two tons, and that the ships take at Montreal for cargo twenty five passengers and 1000 tons, the total movement up and down will be equivalent to 2200 tons, net cost per ton $38\frac{1}{2}$ cents, which is $2\frac{1}{2}$ mills per ton per mile, or $3\frac{1}{2}$ cents per barrel for flour from Montreal to Quebec. To perform this account of transportation by two medium-sized interior steamers fully loaded with 500 tons each, with passenger accommodations, will be as follows:—

Pilotage for both, up and down.....	\$112
Wharfage at Quebec, 5 days, $\frac{1}{2}$ ct.....	50
Coal consumed 40 tons to each = 80.....	320
	<hr/>
	\$482

Prominent merchants largely engaged in the forwarding business between the upper lakes and the ports of Montreal and Quebec, object to sending their steamers to Quebec on account of detentions from the want of suitable wharf space, from the tidal changes, and from the risk of grounding at low water at the wharves; but these evils can be obviated in time by building more wharves and extending them to deeper water, and by a tidal dock for which there exists an admirable site at the mouth of the creek on the north-westerly side of that city. But apart from all local questions, the general accumulation of export products at Montreal, as the terminus of 1500 miles of inland navigation, is much better security against detention of vessels there either for loading or discharging, than can be had at Quebec at any time. We therefore make allowance of one day for each trip in favor of Montreal, and state:

Previous amount brought forward.....	\$482
Three days time in running and mooring at wharves and other detentions, for which the pay and subsistence of officers and men will be.....	215
Interest and insurance 3 days on cost.....	192
For contingent expenses \$50 each.....	100
	<hr/>
Total by inland steamers.....	\$989

Which divided by 2200 tons, as before, gives 45 cents per ton = $2\frac{1}{2}$ mills per ton per mile, and $4\frac{1}{2}$ cents per barrel of flour.

The above shows the comparison between sea-going steamships of 1200 tons and lake vessels of 500 tons. Steamships of 2400 tons are now built for this route, the cost of transport by which, compared with the largest lake craft (800 tons), would show a still larger result in favor of bringing the ocean steamships to Montreal.

The same comparison of sea-going and inland sailing vessel shews a much larger difference in favor of sending ocean vessels to Montreal. (ci)

It is evident, as stated by Captain Childe, that there must be a transfer of cargo between the vessels which are employed in the interior trade and those which are employed upon the ocean, and we agree with the opinion expressed by him that this transfer can be made to the best advantage at Montreal.

As the estimates which have been before given of the cost of transport from the interior, brought the comparison to the two seaports of Montreal and New York, it is deemed proper to continue the comparison across the ocean and to the West Indies and South America.

It is true that there is but little general trade now existing between Canada and these southern ports; but it is evident that the large supplies of lumber in its various forms, which are now drawn from the United States to the West India islands, and to the southern continent, can be supplied from the extensive forests of Canada East by direct shipment on more favorable terms than from the north-eastern ports of the United States, and, as the supplies of these articles at those ports are being rapidly exhausted, it cannot be long before resort must be had to the St. Lawrence for this article of commerce.

The wood exports of the United States to the West Indies and to the southern continent in 1856 amounted to four and a half millions of dollars, being sixty per cent. of the whole wood exports of the country. (d')

The following tables show that the cost of transport from the St. Lawrence to these southern ports does not exceed \$1.50 per ton more than from Boston or New York, which, from the less cost of these wooden products at the former place, would enable the Canada merchants eventually to command the market.

(ci) See Appendix, note Ci.

(d') See Appendix, note D'.

TABLES OF THE COST PER TON BY SAILING VESSELS.

1st. From Montreal to, —

	HAVANA.		JAMAICA.		RIO JANEIRO.	
	Distance miles.	Cost.	Distance miles.	Cost.	Distance miles.	Cost.
At one mill per mile, add cost from Chicago to Montreal, as before...	2910	\$ cts. 2 91	3095	\$ cts. 3 10	6800	\$ cts. 6 80
	1278	2 78	1278	2 78	1278	2 78
Total.....	4188	5 69	4373	5 88	8078	9 58

2nd. From New York to, —

	HAVANA.		JAMAICA.		RIO JANEIRO.	
	Distance miles.	Cost.	Distance miles.	Cost.	Distance miles.	Cost.
At one mill per mile, add the cost from Chicago to New York, as before	1290	\$ cts. 1 29	1495	\$ cts. 1 50	5210	\$ cts. 5 21
	1410	4 46	1410	4 46	1410	4 46
Total.....	2700	5 75	2905	5 95	6620	9 67

The comparison of the distance and cost to Liverpool will be as follows (e) : —

	Miles.	Cost.	
		By sail.	By steam.
1st. From Chicago to Montreal, as before..	1278	\$2.78	\$4.69
From Montreal to Liverpool by Straits of Belle Isle.....	2682	2.68	5.36
Add for towage on St. Lawrence.....		0.30	
	3960	\$5.76	\$10.05
2nd. From Chicago to New York, as before.	1410	\$4.46	\$6.36
From New York to Liverpool.....	2980	2.98	5.96
	4390	\$7.44	\$12.32
Difference in favor of the St. Lawrence route	480	1.68	2.27

(e) See Appendix, note E.

The cost of transport from the western interior to European ports is shown by these calculations to be about twenty-five per cent. cheaper by the St. Lawrence than by any other route. The ocean charges are however nearly twice as much now from Montreal as from New York. This difference is to a large extent accidental, and must gradually and rapidly decrease with the growth of the Canadian provinces. Various considerations, to which we will now allude, confirm this view.

The trade of the port of New York has been long well matured. For a great length of time no burthensome restrictions have existed to discourage her commerce. She has been to all the nations of the world a free port, and her position as regards the inland trade of the lake basins, which her canals have controlled since 1830, aided by a harbour of easy access, has made her familiarly known to the ships of all nations. Her connections with the interior are equally well developed, and a long experience has systematized her forwarding facilities and reduced the cost and charges of transportation from the interior to a minimum. Vessels coming to the port from sea are sure of a cargo of some kind home or coastwise to other ports. In the same way steam vessels and canal barges from the interior lakes and rivers, as well as coastwise, can always count on a return of freight more or less from that accumulation of foreign merchandise which is delivered at New York, to meet the consumption of the Western States, of the State of New York, and of a considerable portion of the Province of Canada. At the port of New York every facility, growing out of a long and large experience in both the interior and the ocean trade, is thus well understood. The port of Montreal, on the contrary, is thus far very deficient in similar advantages. It is but nine years since the restrictive laws of Great Britain, as regards foreign shipping entering the Gulf of the St. Lawrence, were removed. Previous to that time no foreign vessel entered that port. The trade was entirely carried on in British bottoms, and was hampered with conditions which cramped and depressed it, increased the costs of foreign stuffs, and, so far as any commercial regulations can produce such effects, suppressed the commercial capabilities of the provinces and discouraged mercantile enterprise. This exclusion of all foreign vessels kept that large portion of the commercial marine,

including all United States ships, ignorant of the navigation of the Gulf.

The entire absence of lights until very recently gave to the Imperial policy a tendency to discourage a wide knowledge of its waters, and gave to the navigation a bad name which it was the interest of the few ships that monopolized its trade to increase. In 1851 there was not one light-house on the North Shore between Quebec and Belle Isle, a distance of eight hundred miles; add to this that the canal improvements on the St. Lawrence have been but recently completed, and that Montreal could not command an interior trade of any consequence until these were, not merely in regular operation, but well known to shippers on the lakes, and the resources and convenience of the port will be sufficiently understood. The railway communication between Montreal and the interior has been open scarcely two years, while from New York it has been open from ten to fifteen years. Above Montreal the canals around the rapids are on a scale now to pass steam vessels of 800 tons burthen. The enlargement of the Welland Canal to the same capacity, and the construction of the Caughnawaga Canal will render the navigation from the lakes all that can be desired. Below Montreal the river has been deepened within the last four years from eleven feet of water on the bars to eighteen feet of water. Ten lights are now established between Quebec and the mouth of the Gulf, and others are about being constructed, rendering that navigation now comparatively safe. Steam-tugs, established by Government, are stationed at Quebec, and operate below that city, affording facilities equal to any other port to vessels navigating the Gulf waters.

These improvements are being sensibly felt at the ports of Montreal and Quebec. The number of foreign ships entering the St. Lawrence in 1857 was one hundred and seventeen. A fortnightly line of steamships (fifteen hundred ton ships) from Montreal to Liverpool is now successfully* in operation, and is tending fast to make the peculiar advantages of the place, as regards the lake trade, known and appreciated.

* A weekly line of vessels of twenty-four hundred tons is to commence running in August next.

The necessary facilities for utilising the St. Lawrence River are thus being rapidly furnished by Canadian enterprise, but it will take time to make them known, to concentrate capital upon them, to gather in all the available aids to the growth of the trade, and to establish those lines of transportation with the interior which are so essential to the certain, rapid, and economical movement of merchandise, and for preventing undue detention of goods at the shipping port.

As all these different facilities take shape, and the existing deficiencies in these and other respects disappear, it is evident that the port of Montreal will assimilate to the economical position of the port of New York, and will be able more and more to control that portion of the inland commerce for which she is in position so favorably situated.

In further illustration of these remarks, we will enter into some details. (*f*)

During the last six years the Government has been engaged in establishing a thorough system of lights through the Gulf of St. Lawrence, to which allusion has already been made. These, with a more thorough survey of the channels and a more intimate acquaintance with the route on the part of the Gulf pilots and navigators, have even now all but entirely removed the apprehensions which formerly existed as to dangers of the route.

The northern coast of Newfoundland, the Straits of Belle Isle, and the route along the coast of Labrador, through the Gulf of St. Lawrence, are certainly more free from those dense fogs which prevail on the Banks for one thousand miles of the passage, followed by vessels from the north of Europe, than the north-eastern coast of the United States, and the ports between New York and Cape Race. The steamers plying between Montreal and Liverpool uniformly take the passage referred to, through the Straits of Belle Isle, and, in proof of its general exemption from the fogs which prevail during certain months to the south, and also of the shortness of this route, they make shorter passages than the Cunard or Collins steamers from Boston and New York to the same port. (*g*)

(*f*) See Appendix, note F.

(*g*) See Appendix, note G.

The undersigned have made careful enquiries of masters of vessels who have been for a long time engaged in the navigation below Quebec, a few of whom were well acquainted with the navigation through the Straits of Belle Isle, and from all of whom they have received the strongest assurances of the safe and convenient navigation to the open sea by that route, although hitherto it has not been much used except by the steamers aforesaid. (*h*)

The Straits of Belle Isle are more particularly alluded to on account of the shortness of that passage as compared with the route by Cape Race, which is better known and has been more usually taken by sailing vessels.

The River St. Lawrence between Quebec and Montreal has been well lighted and buoyed under the directions of the Trinity Board and Harbour Commissioners of Montreal. A particular examination of the efficiency of their system of lights was made by the undersigned in November last, under circumstances which gave them an opportunity of forming a correct opinion of its value; and they are thus enabled to say, from their own observation, that this portion of the river, as now improved and lighted, presents no difficulties to its safe and convenient navigation.

The more northern portion of the St. Lawrence route may lead to the assumption that it remains closed by ice later than the New York routes. But such is not the fact. The great body of water passing down the St. Lawrence, and its derivation from the upper lakes, the waters of which never attain the low temperature of the streams within the same region of country, seems to more than compensate for the more northern longitude of this route.

The tables in the Appendix will show the dates of the first arrivals of sailing vessels at the port of Quebec, (indication of the river being free of ice), and the dates of the opening of the port of Buffalo and of the navigation upon the Erie and the Canadian canals. (*i*)

The first has been furnished by the Trinity Board at Quebec, and the others have been taken from the reports of the Canal Commissioners of the State of New York, from the reports of the Canadian Board of Works, and other official reports.

(*h*) See Appendix, note H.

(*i*) See Appendix, note I.

It should be remarked that, as respects the downward trade of the lakes, the first and last voyages of the season of navigation upon the canal between Buffalo and Albany occupy about ten days, and between Oswego and Albany about five days, while the voyage between Lake Erie and Quebec by steam vessels would occupy five days, and from Lake Ontario three days.

The mean for the last ten years are derived from these tables as follows:—

	Opens	Closes
Straits of Mackinaw.....	"	"
Port Colborne.....	"	"
Port of Buffalo.....	"	"
Port of Oswego.....	"	"
Port of Albany.....	"	"
Port of Montreal.....	"	"
Port of Quebec.....	"	"
Bic.	"	"
Erie Canal.....	"	"
Welland Canal.....	"	"
St. Lawrence Canals.....	"	"
Cornwall Canal.....	"	"
Beauharnois Canal.....	"	"
Lachine Canal.....	"	"
St. Lawrence River between Lake Ontario, Montreal, and Lachine	"	"
Do. between Montreal and Quebec.....	"	"

Taking into account the difference in time between the voyages from Lake Ontario to Albany or Quebec, and the dates of the opening of the navigation on the two routes, it appears that the navigation is open about five days earlier, and is closed about days on the St. Lawrence route than it is on the Erie Canal.

The large emigrant passenger business which is now concentrated almost exclusively upon New York, might, we should think, by proper exertions, be shared by the port of Montreal, and much in that way drawn to that port, whence a return cargo of flour or grain would be always certain. The emigrant can be

carried to Montreal from Europe for the same charge as to New York with equal profit, and he can be forwarded from Montreal to the Western States for less expense to himself than from the port of New York.

If with these conditions a share of this business cannot be drawn to Montreal now, there must exist prejudices and drawbacks unknown to us which time will ameliorate or remove.

The examination of the question of the location of the proposed harbour at Montreal was also very carefully investigated by the late Capt. Childe, and in the following remarks upon that branch of the question his views will be generally quoted :

The foregoing considerations bring us to the conclusion that the Harbour Commissioners are right in their views respecting the need of an early extension of the harbour of Montreal. As now situated, it is, at best, only a summer harbour, suited to the domestic, coastwise, and river trade, and affording very inadequate accommodation for even the limited number of sea-going vessels of large size which now visit that port. (*j*)

When the channel below Montreal is enlarged to the depth of twenty feet, (which will be done by 1860), the increased number of this class of large vessels together with those of a smaller size from the ocean, and the lake craft which will be attracted to this port by the improvements of the route above Montreal will, more and more, demonstrate that the present harbour accommodations are entirely inadequate to meet the increased requirements of the trade which will year by year be drawn to this point.

The objections to the present harbour are, that it is too limited in extent to accommodate the present amount of commerce, and that unless it be enlarged and improved it will seriously retard the growing trade of the St. Lawrence route; that it does not possess a sufficient area of deep water to accommodate the number of large vessels now running to that port, and that the increased depth cannot be given without endangering the present wharves and rendering the construction of new ones necessary; that it is subject to the fluctuations of the waters in the St. Lawrence, and exposed at some seasons of the year to driving

(*j*) See Appendix, note J.

ice, so that vessels must leave the port in the fall and seek refuge in some of the sheltered bays below Montreal.

* * * * *

This water-route through the St. Lawrence, when improved, has been shown to be cheaper than any other to the sea-board; and when it shall have drawn to itself the business to which it is legitimately entitled, there must go with it such an amount of passengers and light freight traffic, as to give to the parallel railway an increase of business which will be of great value to its revenues.

The remarks which have already been made on this division of business between the water and railway lines, in a preceding part of this report, will further show how dependent each of these systems of transport is upon the other. In the present conditions of trade in this country, neither, as a general proposition, can be successful without the other; and although they are competitors for some kinds of business, yet the advancement of each, (and especially of the water-line,) improves the condition of the other.

The Grand Trunk Railway is now extended to Portland, and will soon be completed to Trois Pistoles, on the St. Lawrence, to which latter place the navigation may be rendered available earlier in the spring and later in the fall.

The dates of the opening of the Welland and the St. Lawrence canals compared with those of New-York and the length of the voyages through them, together with this extension of the season by the railway to Trois Pistoles, will give to the St. Lawrence route an advantage which has not been adverted to in the preceding part of this report.

This advantage will be largely shared in by the Grand Trunk Railway, and especially on that portion of it eastward of Montreal; nor is it improbable that the railway system of Canada may be extended through New Brunswick to Halifax in Nova Scotia, and, by a federation of the provinces under one general government, which has already been agitated and will no doubt be accomplished at an early day, together with the circumstances already alluded to, point to the advisability and security of providing the largest accommodation for the trade at a point which may be so admirably adapted to its transshipment and distribution as that of Montreal.

In the examination of these subjects, we have labored under the disadvantage of the want of an intimate acquaintance with the condition of the trade of Canada which a residence would have furnished. Our remarks have therefore taken a wider range, so as to embrace those districts with which we are more familiar, but which are also deeply interested in the improvement of the St. Lawrence route.

To the people of Canada, however, these are questions of still deeper interest. With a climate, soil and productions at least equal to the contiguous districts of the United States, and having the means of securing not only the cheapest channel to the ocean, but also the cheapest to New England and New York, her future progress must be vastly accelerated.

The countless emigration from Europe which has hitherto passed almost in sight of her rich, healthy and well-situated lands, to seek abodes in the Western States, far removed from the world's markets, and oftentimes in unhealthy climates, and on lands but little if any better than those which lie unoccupied along the water-courses which discharge into the St. Lawrence, will, when these advantages are availed of, settle within her borders, and greatly add to her wealth and prosperity.

A liberal expenditure for the completion of the magnificent public works along the St. Lawrence cannot fail to divert to this route a large share of the trade and travel between the West and Atlantic, and while this will recompense for the expenditure, it will not only add to their commercial prosperity, but will also render her unrivalled advantages known to the stream of emigration which, in flowing through her channels, must be largely attracted to her territory.

The conclusions to which the Board have arrived may be briefly stated as follows:—

- 1st. That the natural advantages of the route between the western interior and the sea-board by the way of the St. Lawrence are sufficient to warrant the expenditures which have been made, and also those which are proposed to complete the improvements along the route; and that, when thus improved, it will present the cheapest mode of communication, not only to the sea-board, but also to New England and New York.

2nd. That the amount of business which will be drawn to this route by the advantages which it will possess when so improved, will be sufficient to warrant the expenditures necessary in making them.

3rd. That the port of Montreal is the proper place for transferring cargoes from the interior to sea-going vessels; and therefore the Harbour Commissioners are right in their plans for deepening the channel below Montreal, so as to allow vessels drawing twenty feet to come to the latter port.

4th. That the present harbour facilities of Montreal are entirely inadequate to accommodate the present trade; and that such an increase as may be expected on the completion of the improvements already mentioned, will require a large addition thereto.

5th. That the location of an enlarged harbour at Point St. Charles is the best site that can be found in Montreal; and that the facilities which a harbour at this place, upon the plan suggested, will amply accommodate the trade in question; and finally, that in our opinion, the improvements in the channel of the St. Lawrence at and near Montreal, and the construction of the proposed harbour, are not local questions, but of national importance, by which the final success of the scheme of Canadian public works will be materially influenced.

The following report by Commander Orlebar gives the state of the St. Lawrence ship channel in the years 1858-59 :—

RETURN

To an address of the Legislative Assembly, dated 4th April inst., for copy of Commander Orlebar's report on improvement of the navigation of the River St. Lawrence.

By command,

C. ALLEYN,
Secretary.

Secretary's Office,
Quebec, 9th April, 1861.

• *Report of the Admiralty Survey of the St. Lawrence above Quebec, 1858 and 1859.*

CHARLOTTETOWN, P.E.I.,

February 29, 1860.

SIR,—

Ably assisted by Commander Hancock and the other officers attached to this survey, I have surveyed and sounded the River St. Lawrence from Lachine Rapids, six miles above Montreal, to Ange Gardien, eight miles below Quebec.

The result of this work, on the scale of three inches to the sea mile, covering fourteen double elephant sheets, is now before me, of which, four have already been sent to England, and the remainder are being copied to transmit to the Admiralty for publication.

As an examination of these places would readily enable your Excellency to judge of the truth of what I now proceed to state, I would have preferred delaying my report until their publication; but aware of the interest taken by the Canadian public, generally, in all works connected with the development of their trade and the improvement of their great river highway, I have decided not to defer submitting to your Excellency my report of the same, and giving my independent testimony to the value of the vast improvements made of late years in the River St. Lawrence above Quebec.

From my arrival at Montreal on the 26th of August, 1858, to the 12th October, 1859, the Montreal Harbour Commission, as well as other public bodies at Montreal and Quebec, have afforded me every necessary information and assistance. The elaborate surveys and plans of soundings of the Harbour Commission, the reports of the various engineers, etc., were all examined carefully, and afforded me complete knowledge of the whole matter, but I felt that to make our survey of real value to the public generally, it ought to be done independently of local aid.

Therefore, whilst we have communicated freely with Captain Armstrong, and received from him information from time to time as to the existence and removal of obstructions and the placing of lights and buoys, we have ourselves re-sounded the whole length of the navigable channel of the river, a distance of

150 miles, varying in width from one-third to one-half a mile. These soundings have been carefully reduced to the same level as that adopted by the Harbour Commission, and answering to the depth of ten feet three inches on the flats of Lake St. Peter.

To carry our chart of the river up to the first real obstacle to its navigation, the survey was extended to the Lachine Rapids, and soundings taken above and below the great Victoria Bridge. Some change in the direction of the channel and set of the current had been effected by the building of the bridge, but the extensive changes wrought in the harbour and near the wharves of Montreal by the dredges of the Harbour Commission were still more noteworthy, and have been faithfully registered on our six inch plan of the harbour of Montreal.

Labouring under no common difficulties, owing to the rapidity of the current off the city wharves, the hard, slaty nature of the bottom and the numerous boulder stones, the Harbour Commissioners have, by skilful dredging, both increased the wharf accommodation and the capacity of the harbour to an extent greater than I could have supposed possible. Still, the increased size of the city, its important position as the terminus of the great ocean highway from Great Britain, its numerous steamers, and its vessels of all sizes, overcrowd the present wharves and require additional accommodation far beyond any possible improvement of the harbour, and I cannot but regard the proposed plan of docks at Point St. Charles as eminently calculated to meet the requirements of the growing trade of Montreal and Western Canada, and to supply the pressing want of safe winter accommodation for steamers and other vessels, whilst in connection with the railroad and canals, it will aid largely the grand purposes of securing and confining the great western traffic to the valley of the St. Lawrence. The immediate neighbourhood of the bridge and railroad, the security afforded by its embankment from damage by current or encroachment by the ice, and the site being the property of the city, seem to point out that part of the harbour as by far the most eligible.

I have now to speak of the river below Montreal. The main channel follows the left bank of the river, deflected occasionally by shoals of boulder stones, more or less towards the middle of the stream, till we arrive at Pointe aux Trembles. Here the dis-

turbing influence of the Ottawa River at the Bout de l'Île divides it into three channels; the main body passes into a narrow channel at one place only 762 feet from shore to shore, and 64 feet deep. At the head of this channel a bank of clay has been cut through and deepened so as to give 20 feet.

At about half a mile below Varennes, two lights have been erected on Île Ste. Thérèse, under the guidance of which the traverse towards Cape St. Michael is made. To maintain a straight channel in the traverse, several obstructions have been carefully removed, and the depth of twenty feet can be carried into the south or Verchères channel, commencing at Cap St. Michel.

By the selection of this channel in preference to the old, the Commissioners have shown excellent judgment, for, by doing so, they avoid the cross currents from the Ottawa River and the more dangerous "pouliers" between Île à la Pâque and Lavaltrie. Along this channel, some deepening has been effected to maintain, as far as possible, a straight course, but nothing in comparison to what would have been required in the other channel. To complete the conveniences of the Verchères channel there is still required a light on Plum Island.

At the end of the Verchères Islands the flats of Contrecoeur oblige another traverse to be taken towards Lavaltrie; the guidance of two lights astern and some dredging has been effected at one or two points to maintain a straight course and the requisite depth of twenty feet.

Arrived off Lavaltrie Islands, we enter the cut across the Lavaltrie bar, deepened from fourteen to nineteen feet; upon the lower part of this canal Captain Armstrong's dredges were at work, and we witnessed with pleasure and instruction the able manner in which the dredges scooped up the stiff clay and stone that form the bed of the river.

Two lights on Lavaltrie Island lead through this cut until abreast of Île Platte, where a white buoy points out a shoal spot, and the course is deflected to the S.E., entering at a distance of two cables the broad, deep, natural channel of the river which continues without obstruction and requiring little notice until we have passed Sorel.

The ship channel passes in a curve northward between Boat and Stone Island; to lead into this channel a fixed light has been

erected on the east end of Stone Island. A slight change of course, leaving this light on the left hand, leads on to the Lake St. Peter.

The great work of deepening Lake St. Peter deserves more than a passing notice. This most judicious and well considered scheme persevered in against much opposition, has been deservedly crowned with complete success, and reflects the greatest credit for the zeal and ability with which the Commissioners have so successfully excavated a channel of eighteen feet through the flats, where in the old time there were only eleven.

The channel over the upper bar, buoyed on the south side, once thirteen feet, we found deepened by dredging to twenty feet, and it lies in a direct line between Raisin Island light and the western light-ship. One and a half miles N. 62° E. from the light-ship, we enter the new cut through the flats. The dredge of the Harbour Commission has deepened this in the upper part, from fifteen to eighteen feet, and lower down, from eleven to eighteen feet, and nineteen in all, a distance of seven miles in an easterly direction to the lower pool. The cut channel is of the uniform width of three hundred feet, and is buoyed on the south side at short distances of less than half a mile.

The lower part of this channel is excellently marked out by the eastern light ship and light on Pointe du Lac, but to mark the requisite change of course, occurring three and a quarter miles below the centre light ship, for safe navigation by night there is something more required than buoys.

I should propose to place there another floating light or high beacon, removable at the close of navigation. Above and below the eastern light-ship, which is on the lower bar, the channel has been dredged to the depth of nineteen feet for the distance of one mile.

On passing the light, this channel bends to the southward; and the course E., S.E., marked out by buoys, leads, at a distance of half a mile from the light-ship, into the deep water of the natural channel, until the lights of Port St. Francis come in line ahead.

Following the usual channel, which passes close to Three Rivers, at two miles below Cape Madeleine, we arrive at the Provenche Shoals. Here the channel used by the pilots only secures a narrow depth of barely nineteen feet, but, following the main

channel to the southward of the shoals, a depth of twenty-four feet can be maintained. This has been recommended by the Harbour Commission, but to make this available by night as well as by day, there should be two lights near the church at Cape Madeline and two lights below—one on Bigot Island and one near Champlain church.

The channel after this follows the north bank of the river until arriving below Batiscan wharf; two lights astern direct a traverse towards Cape Levrard, to avoid St. Anne shoals.

The skill of Captain Armstrong has been tested to maintain a depth of twenty feet at low water passing Cape Levrard. But by careful dredging he has at last succeeded. From our sounding and on inspection of the original survey, I am disposed to think the rivers Batiscan and St. Anne, entering the St. Lawrence at right angles to its course, may occasionally make changes and cause new obstructions in the channel, and that at the commencement of each navigable season, it would be always prudent to examine this and other intricate passes in the river below Montreal.

Two lights at Grondines in line conduct the vessel from Cape Levrard on the E., N.E. course until two other lights on Cape Charles come in line, E., S.E. Below these, the channel is wide and deep, and a due arrangement of lights leads over the Richelieu Rapids, and past the Platon, and so on to Québec.

Throughout this remaining distance of thirty-five miles the river maintains a broad deep channel, with the Pointe-aux-Trembles shoals extending from the north side. Below Pointe-aux-Trembles the flats or bordage strewed with boulder stones contract, and the channel extends nearly from shore to shore.

Narrowed to half a mile opposite the Chaudière and confined between high banks, its depth increases to 174 feet. The great improvement on either bank of the river near Quebec showed the necessity of our re-survey, and a careful re-sounding discovered a decrease in the depth as given in the survey of 1827, in many places amounting to thirty-six feet. This is doubtless due to the immense quantity of ballast thrown overboard from vessels frequenting Quebec during the last thirty years. I have always been of opinion that this must prove eventually injurious, and accumulate in those places where the increased width of the

river diminishes the downward current and allows the water to spread.

To obviate this I would respectfully urge the necessity of a regulation obliging vessels to deposit their ballast in open blocks provided for the purpose along the edge of the bordage, or along the flats of St. Charles.

In conclusion, when the plans of the river are published, it will be apparent to all how judiciously and successfully have all the late improvements been carried out, and also how entirely the added facilities for the navigation of this river are a benefit to the whole people, and are eminently calculated to increase the trade and commerce of the Canadas with the whole world.

With great respect, I subscribe myself,

Your Excellency's humble servant,

(Signed) JOHN ORLEBAR,

Commander in charge of the Survey of Gulf of St. Lawrence.

Work was continued on the lake and river to attain a depth of 20 feet with a width of 300 feet, which was accomplished in November, 1865, as shewn by the following test:—

LAKE ST. PETER.

We have received the following telegram from the party who left Sorel on Thursday with the ship *Ocean* to test the new channel through Lake St. Peter:—

THREE RIVERS, 17th Nov., 1865.

We beg to inform you that the ship *Ocean* left Sorel, drawing 19 feet 8 inches, and passed through the dredged channel in Lake St. Peter to this point, when, at the same time, there were only 10 feet 6 inches on the flats, or in the old channel, being equal to 20 feet 2 inches, with 11 feet on the flats. Before entering the dredged channel, at a point near light-ship No. 1,

the ship took the ground, although there was plenty of water a few feet to the north, and was lightened 6 inches, but reloaded and passed through successfully, as before mentioned.

JOHN YOUNG,
Chairman Harbour Commissioners.

JOHN G. SIPPLE,
Resident Engineer Public Works Dept.

B. STANWOOD,
Captain Ship Ocean.

But although the channel had been thus successfully tested, there remained some difficulty in navigating it in certain places. The ship *Ocean* grounded on a shoal, situated between two pools, at a difficult bend near light-ship No. 1, in Lake St. Peter. This shoal was dredged off in 1866, and the channel thereby improved at that place, by increasing the width from 300 to 800 feet. At Pointe-aux-Trembles (*en haut*) the channel was found to be unsatisfactory, and in 1869 a new location was adopted and improved to 20 feet deep. The operations of 1866-9 were of limited extent, and consisted chiefly in clearing up and improving the 20-foot channel which was obtained in 1865.

The completion of the 20-foot channel marks an important era in the history of the St. Lawrence route. The success of the work amply demonstrated that the St. Lawrence could be made available up to Montreal for navigation by the largest class of ocean merchant ships, and the extraordinary increase of Canadian commerce that attended the improvement of the channel showed how imperatively it was demanded by the trade of Canada.

No sooner was the 20-foot channel fairly in use than the rapid increase of ocean traffic—which was yearly calling forth not only a greater number of vessels, but much larger ones—required a further deepening of the channel,

in order to retain, and if possible increase, the share of the St. Lawrence in the carrying trade of the broad West. Agitation to deepen the channel to 24 feet was vigorously commenced, and through the exertions of the late Hon. John Young and able coadjutors the agitation took definite shape in the following resolution of the Harbour Board, passed 30th September, 1871:—

HARBOUR COMMISSIONERS' OFFICE,
MONTREAL, 29th January, 1872.

H. H. WHITNEY, Esq.,

Secretary Harbour Commissioners of Montreal:

SIR,

On the 30th September last I received yours of that date, accompanied by the resolutions annexed.

“*Resolved*,—On motion of the Mayor, Mr. Coursol, seconded by the Hon. John Young,—That in pursuance of the resolutions passed at the last meeting of the Board, relating to the deepening of the ship channel to Quebec, the Engineer of the Board be instructed to make forthwith such an examination of the ship channel from Montreal to Quebec as will enable him to furnish the Board with an approximate estimate of the cost of deepening the same to a uniform depth of 24 feet, and widening it to a uniform width of 400 feet; said estimate to show also the cost of deepening the channel as above, but leaving the channel at its present width of 300 feet.

“*Further*,—That when the above information has been obtained, consulting engineers be employed, if deemed necessary, with the consent of the Government.

“That he also be instructed to furnish the Board with an estimate of the cost of adapting the harbour for the accommodation of the increased size of vessels which may be expected to visit the port when the proposed improvement of the channel is completed.”

On the 4th October I left Montreal, &c., &c.

(Signed,) A. G. NISH,
Engineer Harbour Commissioners.

The report made in accordance with this resolution was satisfactory, showing the proposed further deepening to be quite feasible at a reasonable cost. It was then decided to continue the work, and the necessary representations were made to the Government. On the 23rd of May, 1873, an Act was assented to, granting a loan of \$1,500,000 and permission for "completing the ship channel in Lake St. Peter and the River St. Lawrence to the depth of not less than 22 feet at low water and a width of not less than 300 feet." On the 10th of July, 1873, an order-in-council was passed, giving permission to the Commissioners to purchase the plant necessary for carrying on the work. Contracts were forthwith let for the building of the necessary vessels, but these were not received in time for use in 1874, and during the first season, only one dredge and one stone-lifter were at work. The following extract from a letter from Mr. Young, Chairman of the Harbour Commissioners, to Mr. Patterson, Secretary of the Board of Trade, dated Montreal, 2nd November, 1874, gives an account of the resumption of the work of deepening the Ship Channel:—

* * * The Commissioners have, therefore, resolved to deepen the channel from 20 to 25 feet at lowest water. There was some doubt as to whether this depth could be obtained, as it was known that rock existed in the channel at Cap Charles and Cap à la Roche, where the tide rises from four to six feet. From an examination, however, which has lately been made by engineers, there is no longer any doubt that, at these places, (50 miles above Quebec), a 25-foot channel at low tide can be secured, while there is no difficulty in getting the same depth through Lake St. Peter and other parts of the river. A new channel, parallel with that now in use at Lavaltrie, a distance of seven miles, has been suggested, on the south side of the river, opposite Contrecoeur, which is very wide and deep, and which will require so little dredging that it is estimated a saving of \$350,000 will thus be made by this change.

A dredge and a stone-lifter have been working at Cap Charles

since the opening of navigation, and next spring the Commissioners will be prepared and ready to begin their great work of the 25-foot channel, with seven powerful dredges, seven steamers or tenders to same, five spoon-dredges, one stone-lifter and 36 scows, which, when fully manned, will give employment to over 400 men, and the consumption of coal for the season is estimated at 15,000 tons. It is proposed to carry a cut throughout, first of $2\frac{1}{2}$ feet, thus securing a channel of $22\frac{1}{2}$ feet—and, when this is done, to go through with another cut of $2\frac{1}{2}$ feet, making the 25 feet. It is supposed that all this will be accomplished during five years. * * * *

I am, Sir,

Yours very respectfully,

JOHN YOUNG,

Chairman Harbour Commissioners.

The following extract from the Chief Engineer's report for the year 1875 gives an account of the dredging plant with which the work was resumed, and with which, with the exception of minor changes in tug-boats and the very important improvements made in the dredges before alluded to, (page 217), the deepening to 25 feet was carried to a successful completion in 1882:—

Report on the deepening of the ship channel between Montreal and Quebec for the year 1875. John Kennedy, Chief Engineer.

HARBOUR COMMISSIONERS OF MONTREAL,

Chief Engineer's Office,

MONTREAL, 1st March, 1876.

H. H. WHITNEY, Esq.,

Secretary.

DEAR SIR,

I beg to submit to the Harbour Commissioners the following report upon the work done, during the year 1875, in deepening the ship channel of the St. Lawrence between Montreal and Quebec.

The improvement of the ship channel between the two cities has

been so often and so fully discussed in its commercial and general aspects, and the work to be done in attaining the various depths has been so fully set forth in the professional reports and estimates of my predecessors, and by Government and other engineers, that I presume little more than a record of the work accomplished in the past year is, at present, required.

DREDGING PLANT.

It will be remembered that, on the Harbour Commissioners being authorized by Government to proceed with the deepening of the channel to "not less than twenty-two feet," they contracted for the construction of six large elevator dredges, similar in principle to the celebrated Clyde dredges, with which to carry out the work. Five (5) of these were received in the latter part of the summer of 1874; but the hull of the remaining one was unfortunately burnt when the machinery was ready to be placed in it, and her completion was, therefore, delayed until June 1st of last year. The six new dredges thus obtained, together with one (No. 3) of similar power, which was employed in the former deepening of the channel, and the old No. 1 dredge, the first ever used on the St. Lawrence—eight machines in all—constitute the actual dredging power engaged in the work.

Two small screw tug boats, to act as tenders to the dredges, were purchased in 1874. Two others were contracted for in the fall of the same year, and were built last winter—one by Messrs. J. B. Auger & Son, and the other by Mr. John McDougall—and two additional ones were purchased in Buffalo last summer.

A double-engine, side-wheel steamer, also intended to act as a tender, was built by Messrs. W. P. Bartley & Co. during last winter, and was delivered over to the Commissioners in spring.

Four additional barges, to serve as small coal tenders, were purchased, as opportunity offered, during the past spring and summer; and fifteen scows, for the transport of dredgings, were constructed, under contract, in 1874.

The above-mentioned craft, together with other previously in the possession of the Commissioners, and one chartered screw tug, formed the dredging fleet employed during the summer, and is of the following strength and approximate present value:—

Six new dredges, Nos. 8 to 13, \$65,000 each.....	\$390,000
One Clyde built dredge (No. 3)	45,000
“ “ “ (No. 1)	20,000
“ Side-wheel tug (John Young)	26,000
Six screw tugs	48,000
One stone lifter.....	2,000
Five barges (coal tenders and store ship)	7,500
Two scows, six years old.....	4,000
Fifteen scows, two years old	42,000
Two “ one year old	4,000
Total	<hr/> \$588,500

The crews of the seven large dredges were sixteen in number all told, with board and wages averaging about \$550 per month; those of the screw tugs averaged eight in number, and amounted to about \$250 per month, while the entire force on the fleet averaged about two hundred, at a monthly cost of about \$7,000.

The new dredges have all proved themselves to be in the main, well-built, powerful machines, and the engines and principal parts have worked well, and without serious casualty. But while this is the case as regards the chief parts, the actual efficiency of the dredges, as a whole, has been much impaired by delays arising from defects and accidents in minor parts of the machinery, and, to some extent, also by the inexperience of the crews with which it was necessary to man them. These drawbacks, which were almost unavoidable in new machines, quite unlike the dredges elsewhere employed on this continent, will, it is hoped, be in a great measure obviated in the future by the repairs and alterations which the present winter has allowed us to make, as well as by the additional experience which has been gained by the crews.

All the tugs have worked well, and, with the exception of three screws broken in shallow water, they have escaped noteworthy accident or loss of time.

The fifteen new scows built in 1874 were all of faulty construction and imperfectly fastened, and have involved rather heavy expenses in maintenance and strengthening. Side trusses and extra fastenings have, however, been added to all of them as successively taken into the ship-yard, and it is hoped that their expenses will be materially lessened in future.

Further details as to the various vessels will be found in the tables
 appended. * * * * * * *

I am, Sir,

Your obedient servant,

(Signed)

JOHN KENNEDY,

Chief Engineer.

The channel was completed to 22½ feet in 1878, as shown in the following extract from the Chief Engineer's report :—

Report upon the Deepening of the Ship Channel between Montreal and Quebec, for the year 1878. John Kennedy, M. Inst., C.E., Chief Engineer.

HARBOUR COMMISSIONERS OF MONTREAL,
Chief Engineer's Office,
MONTREAL, 25th February, 1879.

H. D. WHITNEY, ESQ.,
Secretary :

SIR,—

I beg to submit, for the information of the Harbour Commissioners, the following report upon the work accomplished during the year 1878 in deepening the ship channel of the River St. Lawrence between Montreal and Quebec.

At the close of 1877 the dredging had so far advanced that it became possible, with another year's work, to attain a depth of 22½ feet at low water at all points above the reach of tidal assistance, and thus to give navigation the benefits of the first step of 2½ feet in the contemplated increase to 25 feet. The work of the past year was, therefore, arranged with this object in view, and it was attained ; and proof of the fact was made by the Commissioners, accompanied by their officers and a number of pilots, in a trip through the Channel, on the 18th and 19th November, as set forth in the appended certificate. * * * *

I am, Sir,

Your most obedient servant,

(Signed,) JOHN KENNEDY,
Chief Engineer.

Test of 22 feet Channel, made November 18th and 19th, 1878.

ON BOARD THE STEAMER "JOHN YOUNG,"

November 18th and 19th, 1878.

(OFFICIAL RECORD.)

The undersigned, on Monday, November 18th, embarked on the steamer *John Young*, having spars gauged to a depth of 23 feet 6 inches attached to each side, and left the harbour of Montreal at 8 o'clock a.m., passing through the ship channel, as improved in the harbour, at Point-anx-Trembles, Varennes, Verchères, Contrecoeur, Lake St. Peter, the Nicolet Traverse, and Port St. Francis, over the Pouillier Becancour, the new cut between Champlain and Champlain Point, and Batiscan Traverse to Cap Levrant, without meeting any obstruction. As the gauge on the Flats in Lake St. Peter indicated 12 feet, this establishes a ship channel of 22 feet at lowest water throughout the whole distance thus traversed, or an increased depth of two feet beyond that hitherto available. At Cap Levrant and down to Cap Charles, by taking advantage of highest tide, no difficulty now exists, and below that Point to the Harbour of Quebec the channel is free from danger at a much greater depth than 22 feet at any condition of the tide, so that a reliable new ship channel of 22 feet now exists throughout between Montreal and Quebec.

THOMAS CRAMP,

Chairman Harbour Commissioners.

HUGH McLENNAN,

ADOLPHE ROY,

EDWARD MACKAY,

Harbour Commissioners.

JOHN KENNEDY, *Chief Engineer.*

A. M. RUDOLF, *Harbour Master.*

THOMAS McKENZIE,

Superintendent of Dredging.

JOSEPH LEVEILLÉ,

Superintendent of Pilots.

A. NAUD, *Branch Pilot.*

PIERRE GAGNON, *Branch Pilot.*

I certify to the foregoing statement, so far as it relates to the channel from Montreal to Three Rivers, at which place I was obliged, by other engagements, to leave the steamer *John Young* and return to Montreal.

(Signed,)

J. L. BEAUDRY,

MAYOR OF MONTREAL,

Harbour Commissioner.

I certify to the foregoing statement, so far as it relates to the channel from Sorel (where I joined the *John Young*) to all points below.

(Signed,)

C. L. ARMSTRONG,

Consulting Officer.

I certify to the foregoing statement, so far as it relates to points below Three Rivers, at which place I joined the *John Young*.

(Signed,)

P. M. MATHIEU,

Branch Pilot.

Certified.

(Signed,)

H. D. WHITNEY,

Assistant Secretary.

The depth of 22½ feet being thus accomplished, work was continued to attain the depth of 25 feet at low water resolved on, as seen in the extract from Mr. Young's letter (page 288). This was accomplished in the fall of 1882, when a thorough test of the channel was made on the 3rd of October. The following extracts from the Chief Engineer's report for the year 1882 and the *Montreal Herald* of 5th October, 1882, give an account of the formal opening of the 25-foot channel :—

Report upon the Deepening of the Ship Channel between Montreal and Quebec for the year 1882. John Kennedy, M. Inst. C.E., Chief Engineer.

HARBOUR COMMISSIONERS OF MONTREAL,

Chief Engineer's Office,

MONTREAL, 5th February, 1883.

H. D. WHITNEY, Esq.,
Secretary-Treasurer.

SIR,

I beg to submit, for the information of the Harbour Commissioners, the following report upon the work accomplished during the year 1882, in deepening the ship channel between Montreal and Quebec:—

The object kept in view in carrying on the summer's work was to redeem the promise of some years ago that the 25-foot channel should this year be open for navigation, and special efforts were made that this also should be done as early in the summer as possible, so that its benefits to navigation might be felt during the low water of autumn. For this purpose, two of the largest dredges and a stone-lifter, with the tugs attending them, were worked night and day, and the Montreal harbour-dredging fleet was also, as far as practicable, made to assist the ordinary ship channel plant.

The object was so far attained as to allow of the formal opening of the deepened channel, by a trip through it by the Harbour Commissioners and a number of representative gentlemen, on board the SS. "Peruvian," on the 3rd October last. After the depth had been obtained, most of the dredging plant was kept employed until nearly the close of navigation, in widening, straightening and otherwise further improving the channel at such points as it seemed most desirable to do so. The channel, as it at present stands, may be briefly described as having been deepened and tested to a clear depth of 25 feet at low water, of 11 feet on the Flats of Lake St. Peter at all points above Cap la Roche, but at that point and at Cap Charles adjoining, advantage must be taken of a good average tide to pass with the full depth available elsewhere.

The breadth of the dredged channel is 325 feet in the straight parts in Lake St. Peter between the White Buoy and No. 1 Light Vessel ; 300 feet minimum width in the straight parts elsewhere, with increased width at bends and other places where navigation requires.

* * * * *

At the test trip of the Peruvian, referred to in the Chief Engineer's report, the Chairman, Andrew Robertson, Esq., in the course of his remarks to the company on board, said :—

“ It has been said that some men are born great, others achieve greatness, while some have greatness thrust upon them. I feel to-day that the latter is my case, and, if Providence had so ordered affairs, I would have been glad that one who, for a lifetime, gave to this great work his energy, care and thought, had been spared to stand in my place to-day. I refer to the late Hon. John Young. Just seventeen years ago, or to be exact, on November 16th, 1865, the gentleman whom I have just named and who was so well known to most of those who now hear me, had the pleasure in seeing the reward of his labours to that time in bringing down the ship Ocean in what was then called the 20-foot channel, and who I am sure would have been glad to see the completion of another stage of this great work. The position that I occupy to-day is one of no mean honour, and was unexpected by me ; but being appointed and having accepted the responsibilities as well as the honour conferred, I feel that it would be wrong if I did not, on this occasion, remember that others sowed the seed of which we are reaping the fruits to-day. In looking back, what do we find : that in 1850 the natural channel was called eleven feet on the flats of Lake Saint Peter ; in 1853, or three years thereafter, we find the channel deepened to sixteen feet ; in 1859, six years later, eighteen feet was obtained, and the crowning victory was supposed to be accomplished when in November 1865 twenty feet was obtained. From that time onwards, for several years, resting on their oars seemed to be the policy of the Harbour Commissioners, till in May 1873 an Act

was passed, the then commissioners being Messrs. Delisle, (Chairman), Workman, Bernard, Stephen and Hugh McLennan. The first three have been called away, Mr. Stephen regrets his absence, but we have with us, I am glad to say, Mr. Hugh McLennan, our senior Commissioner on the present Board and one who was most active in procuring the legislation which has enabled the work to be completed. This Act provided for a loan to be raised by Government of a million and a half of dollars to deepen the channel to not less than twenty-two feet, under the superintendence of the Minister of Public Works, either by the Harbour Commissioners of Montreal, or such other arrangements as the Minister of Public Works might make with them. In November of 1878 the then Harbour Commissioners, of which my friend, Mr. Cramp, was then Chairman, were able to announce that twenty-two feet had been obtained; so we this day are able to say that twenty-five has been reached. In looking to the future comes the question,—What are we to do, stand still or go ahead, by deepening the channel still further; and, if so, to what extent? * * * * *

“ Were I sure of the financial question being properly settled, I would have no hesitation in expressing my opinion, which I believe is shared in by my co-Commissioners, as to what should be done, but knowing that for the present, under our greatly reduced tariff of dues, we have reached the prudential limit of expenditure for our income, I feel that caution is desirable. Yet I must say, (and in doing so, I do not wish for a moment to embarrass my honorable friend, the Minister of Public Works, nor to commit him to any expression of opinion,) that the Harbour Commissioners are unanimously of opinion that the Dominion of Canada ought to assume the debt which has so far been incurred for the deepening of the channel since Confederation, and not only so, but should further grant the sum required to deepen the channel to twenty-seven and a half feet, which can be done so much more cheaply now than at any future time. There are strong reasons why we should not stop now. That of the plant as has been already stated; next the fact that at all our competitive points on this side of the Atlantic they are carrying on their improvements to this or greater depth. We must, therefore, keep pace with them or be beaten in the race,— the shortness of the

season we cannot overcome ; we must, therefore, mitigate this drawback as far as possible by improving our facilities in both the river and the harbour. Then we must not forget that in five years' time we are promised that the Canadian Pacific Railway will be completed, which I feel will mark an era for the Saint Lawrence route, and for which we must be prepared. I have no doubt the time is not far distant when all the accommodation that Montreal and Quebec can offer will be taxed to the utmost of their ability. Then for our harbour we must progress, and were the deepening of the channel assumed by the Government, both for the past and for the future, there would be no difficulty experienced by the Harbour Commissioners in borrowing all the money they require for the improvements and extension of the harbour at a reasonable rate of interest ; and, while speaking of the harbour, might I ask the Mayor and those members of the Corporation who are with us to-day, when they expect to report the amount of assistance they are going to give the Harbour Commissioners to help making Montreal a free port, so called, and about which so much was said and written a year and a half ago. It is gratifying to say that the Harbour Commissioners, both past and present, are naturally proud of the success which has thus far attended their labours, but they cannot forget their chief engineer, Mr. John Kennedy, but for whose untiring energy and skill the work would not have been so early and successfully accomplished. They are also glad to say that for these improvements so far they have not received from the Government one dollar since Confederation. It is true that they have advanced the money for the work, but it is equally true that the interest has been regularly paid to the Government out of the ordinary revenue, the sum so far being about four hundred thousand dollars, this making the cost of the twenty-five feet channel nearly two and a quarter million of dollars, before the effects of the improvement could be made available ; the beneficial result of which, it is to be hoped, will from this time be apparent. They also congratulate themselves for the economy with which the work has been conducted. The grant of a million and a half was made for a channel of not less than twenty-two feet, whereas one of twenty-five feet has been obtained for nearly that sum, taking the plant into consideration, and for this magnificent result Mr. Kennedy deserves all

the honour. In saying that the channel debt should be assumed by the Government, let me say that I believe that no expenditure which has been made on railways, canals, or other public works, has been, will be, of such vital importance to the Dominion as a whole, or will yet show such splendid results for the amount expended, as that of the work we this day have officially opened."

As the work of deepening the channel to 25 feet approached completion, the growth of the St. Lawrence trade was seen to require still further improvement of the channel, and the Harbour Commissioners of Montreal, through the following representations, obtained permission, by an order-in-council passed 14th June, 1883, to proceed with a further deepening to 27½ feet at low water. Here follow also the memorials and letters from the Harbour Commissioners, praying that the ship channel debt be assumed by the Government and that the improvement of the channel be treated as a public work.

Letter from the Acting Chairman of the Harbour Commissioners to the Hon. H. L. Langevin, C.B., &c., &c.

HARBOUR COMMISSIONERS OF MONTREAL.

Montreal, 1st December, 1880.

The Hon. H. L. Langevin, C.B.,
&c., &c., &c.

DEAR SIR,—

Feeling the importance and the urgent necessity for some action regarding the River and Lake Channel debt, the Board of Harbour Commissioners have prepared a memorial to his Excellency the Governor-in-Council on the subject which will be sent up to-morrow. I have the honor now to send you herewith two printed copies of the same, as also copies of the memorandum submitted to the Hon. Minister of Public Works by this Board in 1879.

I am requested to ask your most favorable consideration of these documents, and I confidently trust the result will be satisfactory to us.

Will you be good enough to let us know when you will be in a position to receive a deputation from this Board on the subject. The time is getting short now, but the Board had hopes that you would desire to take up the question before the meeting of Parliament.

Allow me also to ask if you have looked at the draft of the bill sent by this Board to the Hon. Minister of Marine. Recent events on the river, added to representations by those interested in its navigation, render it necessary that the powers asked for in that bill should be obtained, and we trust you will secure its passage the coming session.

If you desire it, a few more copies of the memorial will be sent.

With highest regards,

I remain,

Your most obedient servant,

HENRY BULMER,
Acting Chairman.

*Memorial from the Harbour Commissioners of Montreal to the
Governor-General, December, 1880.*

To His Excellency the Right Honorable Sir John Douglas Sutherland Campbell, Marquis of Lorne, P.C., K.T., G.C.M.G.,
Governor-General of Canada, &c., &c., in Council assembled.

The memorial of the Harbour Commissioners of Montreal represents respectfully,

That your memorialists feel it to be their duty to approach your Excellency in Council, with reference to the important work with the direction of which they are charged by the Government of the Dominion.

That on the 31st of March, 1879, they had the honor of submitting to members of your Excellency's Government a memorandum, (a printed copy of which is herewith enclosed,) setting forth the progress that had been made since the year 1851 in deepening and enlarging the channel through Lake St. Peter, showing that since the 12th June, 1851, the channel, which at that time had only an available depth of 12 feet, had been so far

improved and enlarged as to have a minimum depth of 22 feet, and a minimum width of 300 feet. And that in order to attain that measure of success, your memorialists had then expended, out of the loan provided for by the 36 Vic., chap. 60, a sum of \$1,120,000, of which an outlay of about \$500,000 was represented by plant and machinery, all of which still remain on hand.

That since your memorialists submitted that memorandum, they have continued the works for the improvement of the channel, and in so doing, a further sum of \$304,000 was expended upon them during the years 1879 and 1880, by means of which a large portion of this channel has been further deepened to a minimum depth of 25 feet.

That if your memorialists are permitted to continue their operations during next season, they will be able to complete the deepening of the entire channel to the above stated minimum depth of 25 feet, and that the expenses of so doing will not exceed the amount authorized to be raised, under the act above mentioned, for the purpose of deepening the channel to a minimum depth of 22 feet at low water. The value of the plant and materials on hand being sufficient to cover the apparent excess of the total expenditure above the sum of \$1,500,000 contemplated by the said act.

That while your memorialists do not deem it necessary to trouble your Excellency with similar observations to those contained in the said memorandum respecting the value and advantages to the country and to its trade, of the work which they have been mainly instrumental in carrying through during the last 30 years, they beg leave to refer to those observations, and to state that the further experience of two seasons confirms them in the opinion they have expressed, as to the incalculable importance to the Dominion of the improvement of the great marine highway of the St. Lawrence. And they would urge upon your Excellency's consideration the reasons given in that memorandum for regarding the expenses of that improvement as properly chargeable upon the revenues of the Dominion, rather than upon those of the harbour of Montreal.

Your memorialists desire further to observe that public attention has been forcibly attracted, during the past seasons, to the necessity for lightening the burdens upon shipping frequenting

the harbours of the St. Lawrence accessible to sea-going vessels, and more especially the harbour of Montreal; not specially in the interest of that harbour, but of the entire trade and shipping of the Dominion, the prosperity of which depends upon establishing the charges upon shipping at rates which will compare favorably with those of the northern and central harbours of the United States. And with this view, some reduction of the existing rate of charges in the harbour of Montreal and its approaches has been urgently pressed, both upon your memorialists and upon the public generally.

That, as shown by the said memorandum, the interest paid by your memorialists in 1878 upon the amount thus expended under the act of 1873 was \$46,949, and that during the year 1879 the increased expenditure increased the amount of interest paid in that year to the sum of \$54,532.72, while the total revenue of the harbour from ships and steamers during the summer season was only \$58,417.50, shewing a margin only of \$3,884.33 out of the total receipts from sailing and steam vessels visiting the harbour, to assist in covering the maintenance of the harbour and the payment of the debt appropriate to it, now amounting to nearly \$1,800,000. And that when the returns for the recently closed season of navigation have been received, the results will be in a similar proportion to those of the season of 1879.

That, from the foregoing statement of facts, it is obvious that no reduction can be made upon the existing harbour dues, so long as the harbour is held liable for the interest upon the expenditure on the Lake St. Peter and river channel. And that, in fact, the expenditure of the entire appropriation will throw upon the harbour an annual payment, by way of interest, greater than the entire present revenue of the harbour derived from sailing and steam vessels.

That moreover, in order to maintain the position of the harbour of Montreal as the great terminal port for sea-going vessels, improvements and extensions of various kinds are needed and have been recommended by eminent engineers, which it is impossible for your memorialists to contemplate making while burthened with the interest of the expenditure upon the river channel. And that such improvements are as essential to the maintenance and encouragement of the shipping trade of the St.

Lawrence as the reduction of the expenses to be incurred in reaching and using ports on that river, and especially the harbour of Montreal.

That, in view of the facts already stated, it is impossible for your memorialists to contemplate any material improvement of the harbour, or any reduction of rates, so long as they are burthened with the interest upon the expenditure made in the improvements of the channel of the River St. Lawrence; and they would respectfully urge upon your Excellency's consideration the fact that the cost of those improvements to the channel of the River St. Lawrence are as properly and justly chargeable upon the country as the cost of the series of canals of which that great highway forms the extension. And that there is no more ground for throwing the burthen of those improvements upon the harbour of Montreal, than there would be for imposing upon the localities at the termini of the various canals of the Dominion the expenses of constructing those canals.

That in the spring of the present year, your memorialists again brought the said memorandum, and the facts and circumstances which had afterwards transpired, under the notice of your Excellency's Government; and that they then had the honor of receiving from members of your Excellency's Cabinet an assurance that your Excellency's Government would be prepared to submit to Parliament, at its next session, a scheme for the relief of the trade by the St. Lawrence route, which would include the assumption of the debt incurred for the improvement of the lake and river.

That your memorialists communicated that assurance to the public through the Board of Trade of Montreal and by other means, and that it was received with great satisfaction.

Your memorialists therefore would respectfully and earnestly urge upon your Excellency in Council that some measure be taken for the relief of your memorialists and of the harbour of Montreal from the share of the public burthen thus unjustly imposed upon them, in order that your memorialists may avail themselves of the portion of their revenue heretofore appropriated to the payment of interest upon the cost of that public work, in order to reduce the burthens upon shipping and to complete the

improvement of the harbour of Montreal as the central shipping port of the Dominion.

And your memorialists, as in duty bound, will ever pray.

(Signed) HENRY BULMER,
Acting Chairman.

(Signed) H. D. WHITNEY,
Secretary.

HARBOUR COMMISSIONERS' OFFICE,
Montreal, 1st December, 1880.

*Extract from Mr. Robertson's Statement, made at the Public Meeting
of the Board of Harbour Commissioners of Montreal,
12th January, 1882.*

GENTLEMEN,—

In reviewing the proceedings of the year I shall not take up all the subjects in chronological order, but touch only on a few of the more important which have been dealt with during the year. Early in the year the Board made strong representations to the Government that they should assume the cost of deepening the lake and river channel. The Board are unanimous in the belief that this work is fairly chargeable to the revenues of the Dominion, and they have repeatedly memorialized the Government accordingly. Deputations were sent to Ottawa and interviews were had with several of the Ministers, who received us most graciously, and some of whom the deputations thought were considerably interested, if not quite convinced that the position assumed was defensible.

It was found, after great labor and trouble, that the Government could not entertain, at that time, the proposal for the assumption of the debt, and, as a temporary expedient, it was ultimately arranged that the Government, in order to facilitate the reduction of the harbour dues, should introduce a bill that the interest on the money advanced for the purpose of deepening the ship channel, should be reduced from 5 to 4 per cent., and also that the sinking fund should be deferred. These two items, amounting to

about \$30,000, coupled with the large revenue of the previous year (1880), enabled the Board to consider the question of the reduction of dues on goods and vessels. The tariff of dues on goods was remodelled, simplified and reduced, so as to produce an estimated reduction of about $22\frac{1}{2}$ per cent. on these items. The tonnage dues on ships were reduced exactly $33\frac{1}{2}$ per cent.; the total proposed reduction averaged 25 per cent. of the revenue for 1880.

In connection with the reduction of harbour dues, an effort was also made to get the canal tolls reduced on Class 4 or the unenumerated list, the tolls on which yielded but little revenue, being practically prohibitory on many articles. The proposal of the Board was that these goods should, going westward, having paid the St. Lawrence Canal tolls, be free from the Welland Canal tolls, and coming eastward, having paid the Welland Canal tolls, they should be free of the St. Lawrence Canal tolls. The Hon. John Henry Pope, then Acting Minister of Railways and Canals, reported favorably to Council, and an order-in-council was passed carrying out the recommendation of the Board. The results for the season are not yet obtained, but when compiled will no doubt prove favorable, and the coming year will doubtless prove still more so, as the change took place too late to be of any great benefit to the early shipping of last season. * * * *

Report by John Kennedy, C. E., Chief Engineer of the Board, on the further deepening to $27\frac{1}{2}$ feet, 25th January. 1882.

HARBOUR COMMISSIONERS OF MONTREAL,

Chief Engineer's Office,

MONTREAL, 25th January. 1882.

H. D. WHITNEY, Esq.,
Secretary-Treasurer.

SIR,—

In compliance with the instructions of the Board, I beg to report upon the further deepening of the ship channel between Montreal and Quebec to $27\frac{1}{2}$ feet, and also to furnish an estimate of the cost.

FROM QUEBEC TO CAP CHARLES, a distance of 50 miles, there are some points where it is rather doubtful if there is a clear depth of $27\frac{1}{2}$ feet at low water in the present course of vessels, but it is believed that there would be no difficulty in obtaining this depth, either by slight changes in the course or by clearing away insignificant obstructions.

FROM CAP CHARLES UPWARD, the extent of the work to be done has been carefully ascertained by special surveys extending over an aggregate of seventy-seven miles of the channel, as also by sweeping over the bottom of the remaining portions with gauge-bars set at the required depth.

The nature of the materials to be dealt with, and the rate and cost at which they can be removed, are also well known from actual experience in the dredging now in hand, and from borings to greater depths at doubtful points.

This information shows that there would be no special difficulties met in the proposed further deepening, and that it would simply be $2\frac{1}{2}$ feet deeper cutting in all places already dredged over, and an extension in area due to other places where there are shoals with over 25 and less than $27\frac{1}{2}$ feet depth of water.

For the larger vessels, which would be expected to use the deeper channel, all bends and places of any special difficulty in navigation would also require to be widened out to one and a half times or to twice the width of the straight-dredged channels, which are generally 300 feet in breadth.

The floating plant on hand and engaged in the present deepening would be adequate in extent, and in the main, well adapted to the further deepening, but some alterations in the dredges would be necessary to enable them to reach the extra depth without loss of time during high water. It would be wise also, if the increased work be undertaken, to strengthen and improve them, so as to enable them to work more rapidly, and thus lessen both the cost and time for the completion of the work. Their efficiency has already been improved to about two and a half times greater than at the commencement of the recent work, and though not now surpassed by any dredges of which records are obtainable, they could, at a reasonable cost, and by special adaptations to their work, be still further improved in their working rate.

If this be done, this work could, I estimate, be completed in five summers' dredging.

As regards cost, the expenses of the dredging fleet for the past few years have averaged about \$140,000 per annum; but with heavier repairs, as the vessels grow older, and the increased price of labour and fuel, it would not be safe in future to reckon upon less than \$160,000 a year.

Upon this basis, I estimate that the cost of increasing the depth of the channel from 25 feet at ordinary low water, as now in progress, to $27\frac{1}{2}$ feet as proposed, and for a width of 300 feet in the straight portions, and 450 to 600 feet in bends and difficult places, would be:—

For improving the dredging plant.....	\$ 60,000
Working and maintaining the same 5 years, at \$160,000 per annum.....	800,000
	<hr/>
	\$860,000

I may add, as bearing upon the matter, that the cost of the new dredging plant specially purchased for the deepening to 25 feet now in progress, together with the equipment of the shipyard and shops at Sorel, is..... \$534,810

In addition to this there has been appropriated to the work, dredging plant formerly on hand to the value of about..... 100,000

\$634,810

Yours respectfully,

(Signed,)

JOHN KENNEDY,

Chief Engineer.

N.B.—Accompanying this is a small scale profile showing the principal points at which deepening would be required.

Memorial of the Harbour Commissioners of Montreal to the Governor-General, November, 1882.

To His Excellency the Right Honorable Sir John Douglas Sutherland Campbell, Marquis of Lorne, P.C., K.T., G.C.M.G., Governor-General of Canada, &c., &c., in Council assembled.

The memorial of the Harbour Commissioners of Montreal respectfully represents :—

That your memorialists desire again to approach your Excellency in Council, regarding the debt incurred in improving the ship channel of the River St. Lawrence, between Montreal and Quebec, and the further prosecution of this work.

That on the 1st of December, 1880, your memorialists had the honor of making certain representations to your Excellency in Council on this subject, with a view to obtaining some assistance, and they were so far successful that by the Act 44 Vic., chap. 7, the rate of interest on the amounts advanced the Commissioners by the Government was reduced from 5 per cent. to 4 per cent. and the obligation imposed on the Trust by the Act 36 Vic., chap. 60, to provide a sinking fund to pay off the said advances, was cancelled. And, further, by the Act 45 Vic., chap. 44, an additional loan of \$280,000 was made on the same terms, towards enabling the Commissioners to complete the ship channel to 25 feet at low water.

That in consequence of this reduction of interest, your memorialists were enabled to reduce the tonnage dues on shipping $33\frac{1}{2}$ per cent., to that extent cheapening the St. Lawrence route.

That the grants made to the Commissioners amounting to \$1,780,000, have now been expended, and the 25 feet depth of water has been obtained, except at Cap La Roche, where vessels are obliged to take advantage of the high tide in order to have the full benefit of the improved channel. This should be further deepened two feet, and, at some of the bends and places where cross-currents exist, the channel should be widened to insure greater safety.

That your memorialists would further desire to observe that although the improvements now made are of great advantage to the trade by the St. Lawrence, it is generally admitted that the

depth of water must still be increased to meet the demands of trade and enable the St. Lawrence route to successfully compete with American ports.

Your memorialists would also state that they have a large and valuable dredging plant and experienced staff for the further carrying on of these operations, and it would seem injudicious to allow the same to be dispersed, in view of the facts herein stated. That for the further improvements of the river, additional dredging to the extent of $2\frac{1}{2}$ feet is required, and it is estimated that this would cost about \$900,000 and that the work could be accomplished in five years.

Your memorialists would further draw your attention to the fact that of the \$1,780,000 expended, \$575,000 was paid for plant alone, leaving \$1,205,000 as the cost of work already done, in deepening the channel from 20 to 25 feet. Should the deepening be now continued, this plant is available for it, but should the work be stopped, and the plant disposed of, and should it afterwards be found desirable to resume, a similar outlay would require to be made before operations could be again commenced.

That it is expected, in five years time, that the Canadian Pacific Railway will be completed from British Columbia to the St. Lawrence, when, it is believed, an enormous development of traffic will take place. Your memorialists are, therefore, most anxious that the requirements of this new trade should be anticipated and provided for, both by increased depth in the river and accommodation in the harbour. Your memorialists are unable to undertake both, but should the Government be pleased to relieve them of the ship channel, they will then be able to increase the accommodation in the harbour.

Your memorialists would also observe that large grants are annually voted by Parliament for the improvements of harbours and rivers in all parts of the Dominion, while Montreal, the central shipping port in the country, has, since confederation, received no grants whatever, and has not only constructed her own harbour works, but has been obliged to incur large obligations for the improvement of the ship channel of the St. Lawrence, a work which they think is as much a public work as the enlargement of the canals, it being part of the great national waterway to Ontario and the Northwest.

That as a further evidence of the additional burdens which are imposed upon the revenues of the Trust, your memorialists would state that, since 1873, it has fallen to them to maintain the buoys and beacons on the river from Montreal to Portneuf, and in doing so, they have expended upwards of \$70,000, and have only received from your Excellency's Government the sum of \$7,000 on account of said disbursements. Your memorialists would beg to remark that they consider this service should be carried on at the public expense, as is done elsewhere in the Dominion, and should be permanently provided for, as a charge upon the public revenue.

That your memorialists would also call your attention to the fact that the revenues of the Trust are all required for the due maintenance and improvement of the harbour, the payment of the interest on the harbour debt proper, and of the interest to the Government on the above-mentioned loans, which latter sum now amounts to \$71,200 per annum, and on which account nearly \$400,000 has been paid to the Government out of revenue during the progress of the work.

That were the Government to assume the debt and the further deepening of the channel, your memorialists would be enabled to abolish the tonnage dues, which in 1880, the year before the reduction of tonnage dues already referred to took place, amounted to \$78,765, and which, if accomplished, would be an important concession to the shipping interests of the Dominion.

Your memorialists are aware that the Government is having the channel between Cap la Roche and Quebec carefully examined for suspected obstructions, and they urge that a similar examination be made at Crane Island, below Quebec, where deep draught vessels can only pass at certain stages of the tide, and that such improvements as may be found necessary should be made.

That your memorialists view with considerable anxiety the action of New York State, by the recent vote in proposing to entirely abolish the tolls on the Erie Canal, which will no doubt be carried into effect, and be a direct blow at the St. Lawrence route; they would therefore respectfully urge your attention to this subject.

Your memorialists would further call special attention to the fact that at the American seaports, with which the St. Lawrence must compete, the approaches to the harbours are improved

entirely at the cost of the United States Government, and without charge against the harbours. Within the past few years, there has been thus expended by them over \$15,000,000 for the ports of Boston, New York, Philadelphia, Baltimore, and New Orleans, for works which are exactly analagous to the improvement of the ship channel of the St. Lawrence, with which its shipping is now burdened.

Your memorialists would, therefore, for these and other reasons, most respectfully and earnestly request that the representations herein contained may receive the serious and favourable consideration of your Excellency in Council, and that such steps may be taken as will relieve the harbour of Montreal of the burdens above referred to, and at the same time admit of the further improvement of the river, as herein suggested.

And your memorialists, as in duty bound, will ever pray.

ANDREW ROBERTSON,
Chairman.

H. D. WHITNEY,
Secretary.

Harbour Commissioners' Office,
Montreal, 15th November, 1882.

Extract from Mr. Robertson's Statement, made at the Public Meeting of the Board of Harbour Commissioners of Montreal, 8th February, 1883.

GENTLEMEN,—

Another year has passed away, but its history will be remembered as one of unusual interest to this Trust. Last year the Harbour Commissioners found that the loan of one and a half million dollars would not complete the channel to 25 feet, and therefore applied to the Government for an additional advance of \$280,000, which was granted them; the Commissioners paying as usual the interest for the same.

This sum enabled the works to be carried on, and on the 3rd October the channel was formally opened, 25 feet having been

attained all along the river, except at Cap Charles and Cap la Roche, where it is necessary to pass at high tide, as, at lowest water, there is only 22 feet; this should be deepened two feet more to make it regularly available at half-tide, so as to prevent delay in waiting for high water.

The Commissioners again memorialised the Government as to the expediency of their assuming the debt incurred for this deepening; they also laid the case as strongly as they could before them by a personal visit to Ottawa, where they were courteously received and their arguments listened to, receiving the assurance that it would receive the most favourable consideration of the Government. The Commissioners are not without hope that, if it is not immediately done, the time is not far distant when this measure of justice will be accorded to the great national waterway of the Dominion of Canada.

In this connection there came into my hands the other day, through the kindness of Sir Francis Hincks, copies of a series of letters on this subject; they show that, forty years ago, the deepening of the channel was then receiving the careful attention of Government, and was begun as one of the public works of Canada. These are too long to read here, but they are of such historic value that they will be printed as an *addenda* to the report for this year.*

The Commissioners also memorialised the Government as to the further deepening of the Channel, and recommended that, seeing the plant was of such consequence and of so great a value, that before disposing of the same and dispersing the well-trained crews, another cut of $2\frac{1}{2}$ feet should be made, at an estimated cost of \$860,000, or under \$900,000. The nearness of the estimates for the 25 feet channel to the amount expended, considering the value of the plant on hand, was surprisingly close, and they, therefore, had no hesitation in urging this view upon the Government, convinced that the result, when accomplished, will be found within the sum named.

Mr. Kennedy made a report, dealing with the subject, which was also forwarded to the Government, objections having been made by some that it would be impossible to further deepen, and that it will cost millions, &c., but these are mistaken views, and in corroboration of Mr. Kennedy's views, a report has been received from Thomas C. Keefer, Esq., endorsing Mr. Kennedy's report, and recommending in future even a greater depth.

* See this pamphlet, pages 65 to 82.

These two questions are now being considered by the Government, and the Commissioners hope they will be dealt with in a proper spirit; should all that has been asked for not be granted, it is to be hoped that such measures of relief will be afforded as to further relieve the shipping trade, and help to secure for the St. Lawrence route a fair share of the traffic passing from the boundless West to the eastern continent.

Under any circumstances, it will be a great mistake to allow the fleet to go to waste and the skilled workmen to be dispersed, should it be afterwards found that it is advisable or become necessary to continue the work at some future time. * * * *

Report by T. C. Keefer, C.E., on the further deepening to 27½ feet. 25th January, 1883.

SAN GABRIEL, CALIFORNIA,
20th January, 1883.

JOHN KENNEDY, Esq.,
Chief Engineer,
Harbour Commissioners. Montreal.

DEAR SIR,—

I beg to acknowledge the receipt of your letter of 21st ult., informing me that you are directed to ask, for the information of the Harbour Commissioners, my opinion "as to the feasibility of deepening the ship channel between Montreal and Quebec to 27½ feet, or possibly to 30 feet at low water—the effect of such further deepening on the level of water in the harbour of Montreal and elsewhere—and upon any other point I may deem important." I have received, in connection with this, a profile of the river bottom, showing character of materials met with in dredging for 25 feet depth. I also learn that test-borings have been made at Point-aux-Trembles, Nicolet Traverse, Port St. Francis, Champlain and Batiscan Traverse, to a depth of 30 feet at low water, and that, in all cases, the material is practically uniform to this depth; that in certain parts of the Contrecoeur channel, and in many places in Lake St. Peter, screw anchors and poles have been put down to a much greater depth without revealing any change. Also that in the shale rock of Cap

Charles and Cap la Roche many borings for "lewis bolts" and for blasts have been made to depths of about 26 feet at low water, and a few to greater depths without meeting strata different from those already dredged.

There does not seem to be any reason to doubt the feasibility of deepening the ship channel to $27\frac{1}{2}$ or 30 feet (the practicability of doing so is undoubted, as it is at most a question of expense) without greater difficulties or greater relative expenditure than have been encountered in the deepening already attained, and without injurious effects on the levels of the river. The only rock encountered is shale—removable by dredging; and as this is a formation known to be elsewhere of great thickness, it is more than probable that it will *everywhere* extend below the 30 feet line, as I understand it has done in some of the cases where borings have been made. So much of the work of deepening the ship channel has already been done efficiently and economically, that the cost of completion can be closely determined, and to the alterations in the dredges which will be necessary to enable them to reach the extra depth, those you recommend to improve their working rate will no doubt be added, so that the proportional cost of the new work to that which has already been done will not be increased. The great result within the reach of the Harbour Commission can be obtained at a comparatively small expenditure, in consequence of the very large and efficient dredging plant on hand, which has cost over \$600,000, and is in itself nearly half the battle.

I do not think that the deepening of the ship channel to 30 feet can have any effect on the level in the harbour of Montreal, because that level is governed by the contraction of the channel at Ile Ronde and the general condition of the river's breadth and depth thence to Lake St. Peter. The effect at other points (below Montreal) will be extremely slight and local, confined to the points where dredging is done, and will not reduce the navigable depth of the river anywhere. In cutting through a shoal of greater or less extent there will probably be a lengthening of the slope of the surface current or ripple at that shoal at the point where the cutting is made, but no effect will be produced on the surface of the deep reaches above that shoal, the water of which cannot be permanently lowered, so long as there is as much coming into that reach as there is going out of it, which obviously must be the condition of things all over the St.

Lawrence at the same period of time. No amount of deepening at a point can increase the general discharging capacity of the river, which increase could alone lower its levels at that point. Moreover, the dredged channel is insignificant as compared with the general dimensions of the St. Lawrence, a general enlargement of which would be necessary in order to lower its level between Montreal and Lake St. Peter. In this lake, where the greatest length and depth of dredging has been done, no permanent lowering of its level can be artificially produced, on account of the tide and the great expanse of surface, the level of which is not seriously affected by the short duration of the ebb, though subject to variations by freshets, winds and tides. In the 50 miles of river above this lake, there are a dozen points where deepening has been done, aggregating about thirteen miles, between 25 and 30 per cent. of the whole distance. In the reaches between the points of dredging, the depths range between 40 and 50 feet generally. The river in these sections cannot be disturbed in its regimen by any local effect produced by the dredge on the shoals below them. If more water passes at the dredged channel, less will pass the shoals at other points, and as all the dredged material is dropped in the river, it is obvious that it can, if found desirable, be so deposited as to leave the discharging capacity at the shoal as before.

I think, however, that the most satisfactory evidence of the probable effect of increased deepening is that which is afforded by experience. A channel 300 feet wide has been excavated through the bed of Lake St. Peter for a distance of over 17 miles continuously, much of it to a depth of 14 feet below lake bottom, and a similar channel has been cut through all the shoals above, between this lake and Montreal, without disturbing the ordinary levels of the St. Lawrence either in the harbour of Montreal, or elsewhere. If this has been the result of cutting through shoals to the extent of 14 feet, in many cases, there is little reason to fear the effect of an additional $2\frac{1}{2}$ or 5 feet of deepening.

The river level, below Montreal, depends upon the levels of the Ottawa and St. Lawrence rivers above that point, and if lower water than usual has been observed since the dredging operations were far advanced, as in 1879, it will be found to have been general and as unprecedented above Montreal as below it.

As to the general question—the policy of further deepening at the

present time—every consideration seems to favour it. Ocean steamers are built and building with a load line requiring more than 25 feet depth of canal, a greater depth being needed in a narrow channel than in a wide one. These vessels should, if possible, be enabled to ascend to Montreal in the interest of the whole Dominion west to the Rocky Mountains. Practically, ocean freight with foreign ports will be the same to and from Montreal as to and from any port in the river below it, perhaps more favourable, as Montreal must continue to be the best point for finding outward cargo. Glasgow has drawn the ocean vessel from Greenock, Manchester is seeking to extend ship navigation from Liverpool, and Paris from Rouen, for economic considerations.

The possession of the "plant" enables the Harbour Trust to continue the work now as fast or as slowly as its available means may determine.

It would be deplorable if this great work of the ship channel were stopped at a point where it is so near meeting every requisition which may be made upon it, so near making Montreal accessible for any draft of vessel as the best harbours on the Atlantic coast or elsewhere. The depth aimed at from time to time during the last forty years has never yet been with the view of meeting every emergency, but has rather been experimental and more a financial than a commercial question. Before 1850 the depth provided for was $16\frac{1}{2}$ feet at low water. After that date, it was decided to extend to 20 feet, not that 20 feet was the proper figure, but it was as much as could be carried at the time, though only a step in the right direction. Up to this time, opposition was variously based on the assertion that the channel would fill up, but the success attending the attainment and maintenance of this depth extended it to 25 feet, which, valuable as it is, is insufficient at low water for vessels of 25 feet draught and over, such as are now to be found on the Atlantic. Another five feet will certainly be a final demand and no doubt less than that depth will serve for some time to come. In all cases when the shoals are very short, it will be as well to go to the fuller depth at once, as the time for reaching the ground, mooring, etc., and the preparations required, form, for a small amount of dredging, so large a proportion of the cost.

If what has been undertaken, in the past, was warranted by the then condition of things, *à fortiori*, present prospects and necessities

make it imperative that the chief Dominion seaport should be placed upon a par with any American one, as to its accessibility by the largest ocean vessels. Montreal, a fresh water seaport, 250 miles above salt water, and nearly 100 miles above tide, is nearer to Europe, the market, and nearer to the great grain and provision areas of this continent, the sources of supply for that market, than any of her Atlantic competitors in that trade, not excepting New York, the great emporium of the export and import trade of the United States. She is the terminus of the longest inland water communication between the Atlantic and those areas, and has two distinct railway systems of the first magnitude, to supplement and perfect her communication with the interior—the Grand Trunk, in full operation, and the Canadian Pacific, an assured reality in the near future, besides the more than probable future extension of the Northern Pacific Railway to tide water by its shortest route, Sault Ste. Marie and the Ottawa Valley. Nor is it improbable that a trunk line on the south side of the St. Lawrence will sooner or later connect Northern and Western New York, Western Pennsylvania and Ohio, and points beyond, with the coolest route for grain and provisions and the most favorable one for live stock by reason of the extent of river and gulf navigation and the minimum of ocean transit. With such a position and prospect nothing but poverty can warrant any delay in making the Canadian New York accessible to the largest ocean steamers. I fully recognize the grave objection to burdening the commerce of the port with an expenditure for a work which is as much a public one as the canals and harbours above or below it. The rivers and harbours of the inland waters of the United States are recognized as Federal works, and this is the case in Canada with respect to the St. Lawrence at all other points, the navigation of which is exclusively under Dominion control. I believe, therefore, that the entire assumption of this work by the Dominion is but a question of time (and that a very short time), and there is certainly no national expenditure to which the surplus revenues of the Federal Government can be more usefully devoted than that which brings the largest ocean vessels within the greatest possible proximity to the heart of the continent.

I remain,

Your obedient servant,

(Signed,) THOS. C. KEEFER.

Letter from Andrew Robertson, Esq., Chairman of the Harbour Commissioners of Montreal, to the Hon. Sir Hector Langevin, K.C.M.G., C.B., inclosing a letter from John Kennedy, Esq., Chief Engineer.

HARBOUR COMMISSIONERS' OFFICE,
MONTREAL, 19th April, 1883.

HON. SIR HECTOR LANGEVIN, K.C.M.G., C.B.,
Minister of Public Works, Ottawa.

SIR,—

I am instructed by the Board of Harbour Commissioners to state that at their meeting yesterday, their attention was called to a communication which appeared in the *Quebec Chronicle*, from Joseph Shehyn, Esq., President of the Quebec Board of Trade, addressed to yourself, against the further deepening of the ship channel between Quebec and Montreal, at the public expense; and while the Commission do not wish to trouble you unnecessarily, as you are already so well aware of the facts, yet they are of opinion that Mr. Shehyn's letter should not be allowed to pass without comment.

You are already aware that the harbour of Montreal is a work entirely apart from that of deepening the channel, and that the expenditures are kept entirely separate.

In 1867, when Confederation took place, the indebtedness of the harbour of Montreal was as nearly as possible \$1,126,000; since that time, there has been expended on the harbour proper over \$1,520,000, making in all \$2,646,000; the present indebtedness is \$1,881,000, being a difference of \$765,000, which has been paid out of the revenue. It may be safely assumed that the harbour of Montreal, which means from Windmill Point to Longue Pointe, has cost over three million dollars, towards which expenditure the Federal and Local Governments have never contributed one cent, nor do the Harbour Commissioners propose that they should do anything of the kind. They borrow the money on their own harbour bonds, which have no guarantee from the Government, and they have paid their interest regularly, which at present is a yearly charge of \$114,000.

This statement will at once eliminate any reference in Mr. Shehyn's letter to the harbour of Montreal as a charge upon the Government, for either guarantee of principal or interest, whereas he admits that

the Harbour Commissioners of Quebec get the money they require advanced by the Government for harbour improvements in Quebec, while the Montreal Harbour Commissioners are obliged to borrow from the public at much higher rates.

As to the deepening of the ship channel, he says "that from 1856 to 1867 the Harbour Commissioners of Montreal had spent for deepening the channel through Lake St. Peter a sum of \$1,164,235, which was assumed by the Government." Admit the fact, what does this prove; that the Government of the day considered the deepening of the ship channel as a public work.

On the other hand, we cannot look upon the work in any other light than as one of the public works of the Dominion and beneficial to the commerce of the country at large. The work was at first undertaken by the Government and carried out by dredging plant belonging to the Government and under the oversight of the Department of Public Works, in precisely the same way as the channel through Lake St. Clair, the St. Lawrence Canals or any other great public works were carried out. Subsequently, the further deepening of the ship channel to 20 feet was handed over to the Harbour Commissioners of Montreal, but it was inspected by the Chief Engineer of Public Works, and the cost assumed, as already mentioned, by the Government, thus again placing it on the same footing as other public works.

Mention has already been made of the deepening of the ship channel between Lakes Erie and Huron, which has been done by Government as a public work, and we think properly so. It is an improvement of the great national water way from the ocean to the upper lakes, and as such is certainly in the interest of the Dominion at large. The Galops, on the Upper St. Lawrence, is another point being deepened by Government, and at enormous expense in proportion to the extent of work. And precisely the same reasons which have caused these to be looked upon as public works, apply to other parts of the river. There is no reason for the deepening of the Lake St. Clair Flats, the Detroit River and Upper St. Lawrence by Government, which does not apply with tenfold force to the deepening of Lake St. Peter Flats and the St. Lawrence below Montreal by Government. They are simply sections of the same work, but the part between Montreal and Quebec is vastly the most important.

The authority under which the further deepening to 25 ft. has just

been finished is an Act of the Dominion Legislature passed in May, 1873 (36th Vict., chap. 60), authorizing the Government to contract a loan to defray the expenses, and the work to be performed, either by the Harbour Commissioners of Montreal, or in such other manner as the Governor-in-Council might determine, but to be under the superintendence of the Department of Public Works. The authority to proceed was given the Harbour Commissioners of Montreal in terms of this Act, and under it the work has been executed; that is to say, the Harbour Commissioners have, in fact, acted as the agents of the Government so far as the execution of the work was concerned.

The money advanced by the Government is now \$1,780,000, on which the Harbour Commissioners of Montreal have regularly paid the interest out of the harbour revenue, just as Mr. Shehyn admits that the Government have advanced money for the Quebec Harbour Improvements—the difference being that the Government have advanced in the case of Quebec for local improvements and in the ship channel case, we think, for public improvements.

The lake and river improvements have cost since Confederation to date, including plant, \$1,780,000, for deepening the channel from 20 to 25 feet, and the Commissioners are of opinion that the same should be further deepened to the extent of $2\frac{1}{2}$ feet, at a cost of say \$860,000 to \$900,000. It is this debt and the further deepening of the channel which the Commissioners wish the Government to assume, as they are fully and unanimously of the opinion that the channel is a public work of benefit to the whole Dominion, and is not a local work, as is the improvement of the harbour of Montreal. Now, supposing that the Government were to assume the debt, and to agree to further grant the needed sums to deepen the channel to $27\frac{1}{2}$ feet, it would come to \$2,680,000, but as the plant, after $27\frac{1}{2}$ feet is obtained, would certainly yield one-third of the cost, deducting say \$180,000, would leave two and a half millions as the cost of a $27\frac{1}{2}$ feet channel, at an annual charge of one hundred thousand dollars a year at 4 per cent.

Mr. Shehyn takes exception to this and says: "It is a well known fact such a work as they propose handing to the Government would likely cost a couple of millions."

What is his authority for this statement? I have given you Mr. Kennedy's report and also Mr. Keefer's, endorsing the same, as you will see in the Harbour Reports for 1882, pp. 14-22, copy of which

is herewith. The accuracy of Mr. Kennedy's estimates heretofore is a good guarantee that he is again correct, and the Board have implicit confidence in his estimates, but to prevent any doubt, I enclose copy of letter from him on this point, appended herewith.

The Commissioners regret extremely that Mr. Shehyn should have introduced into his letter so much sectionalism. He seems to forget that it is not the ports of Quebec and Montreal who are to fight each other, but that it is the St. Lawrence ports in summer and the Dominion Atlantic ports in winter, as against the Atlantic ports of the United States all the year round.

It is on this broad ground that the Commissioners base their case, and they consider that, for the money expended and to be spent, the deepening of the ship channel is decidedly the cheapest and most useful work that the Government could undertake.

I have the honor to be, sir,

Your most obd't. servant,

(Signed,) ANDREW ROBERTSON,
Chairman.

HARBOUR COMMISSIONERS OF MONTREAL,
Chief Engineer's Office.

MONTREAL, April 18th, 1883.

Andrew Robertson, Esq.,
Chairman, &c.

DEAR SIR,—

I beg to acknowledge the receipt of your letter of to-day, calling my attention to the letter of Joseph Shehyn, Esq., President of the Board of Trade of Quebec, published in the *Quebec Chronicle* of the 16th instant; and particularly to that part of the letter relating to the estimate for continuing the deepening of the ship channel between Montreal and Quebec to 27½ feet.

Mr. Shehyn, I find, questions the sufficiency of the estimate of \$800,000 to \$900,000, and says that it is a well-known fact that such a work would likely cost a couple of millions.

On this I beg to remark, and with every respect, that Mr. Shehyn is entirely mistaken, and what he calls a well-known fact is only some one's guess. On the other hand, the Harbour Commissioners of Montreal, from their dredging in the ship channel for over 30 years past, know precisely the extent and character and cost of the work, and from these data, the cost of continuing is readily and accurately estimated, subject only to such variations as may occur in wages and the price of fuel and stores.

It is not a new work, nor even a work in new and untried places; but, with insignificant exceptions, it is simply continuing, on well-known ground and by well-trying methods.

In the eight working seasons just past, we have, as a matter of fact, deepened the channel five feet, that is, from a depth of 20 feet to one of 25 feet, at a cost of \$1,780,000, including \$534,810 for the purchase of plant, which plant is now on hand for going on with the work. The cost of deepening, apart from the purchase of plant, has therefore been about \$625,000 for each $2\frac{1}{2}$ feet, and obviously, with plant already on hand, my estimate of \$860,000 is an ample one for the next $2\frac{1}{2}$ feet required to attain the proposed depth of $27\frac{1}{2}$ feet.

Yours respectfully,

(Signed,)

JOHN KENNEDY,

Chief Engineer.

*Extract from Mr. Robertson's Statement made at the Public Meeting
of the Board of Harbour Commissioners of Montreal,
17th January, 1884.*

GENTLEMEN,—

The most important matter during the past year which the Commissioners had to deal with in connection with the Trust reposed in them, was application made to the Government and Parliament to pass an act granting a loan of \$900,000 for the further deepening of the channel to $27\frac{1}{2}$ feet.

This encountered very great opposition in various quarters, the more so as the Commissioners suggested that the deepening in the

past, as well as in the future, should be treated as one of the public works of the Dominion, and not as a local work.

The President of the Board of Trade of Quebec addressed, under date of 10th of April last, a letter to the Hon. the Minister of Public Works against these views.

Under date of 19th same month, a letter was addressed by the Board to the Hon. the Minister of Public Works in reply, answering the same (copy which has been already published in the papers, but is hereto appended). The result being, that after repeated deputations to Ottawa as well as considerable correspondence, the Government brought in a bill granting a loan of \$900,000 at 4 p. c., which enabled the Commissioners to proceed with the work,—and which it is believed will be completed by the time stated—and will no doubt be found, when finished, a benefit to the city as well as to the Dominion.

Some delay was caused, in consequence of the caution of the Government to satisfy themselves that the work could be performed for the sum named, and they very properly employed their engineers to enquire into, and report to them, before passing the order-in-council which was required to confirm the act. The reports being favourable, the order-in-council was finally passed on 14th of last June.

During my visit last summer to Great Britain, I devoted a portion of my time to seeing the improvements carried on in various quarters, and more especially on the Clyde. At Greenock and Glasgow, the mode of operations there is somewhat different to ours, and no doubts suits their circumstances. They use steam Hopper barges, which carry out the dredged material to sea or some of the deep lochs which lie in the Frith of Clyde.

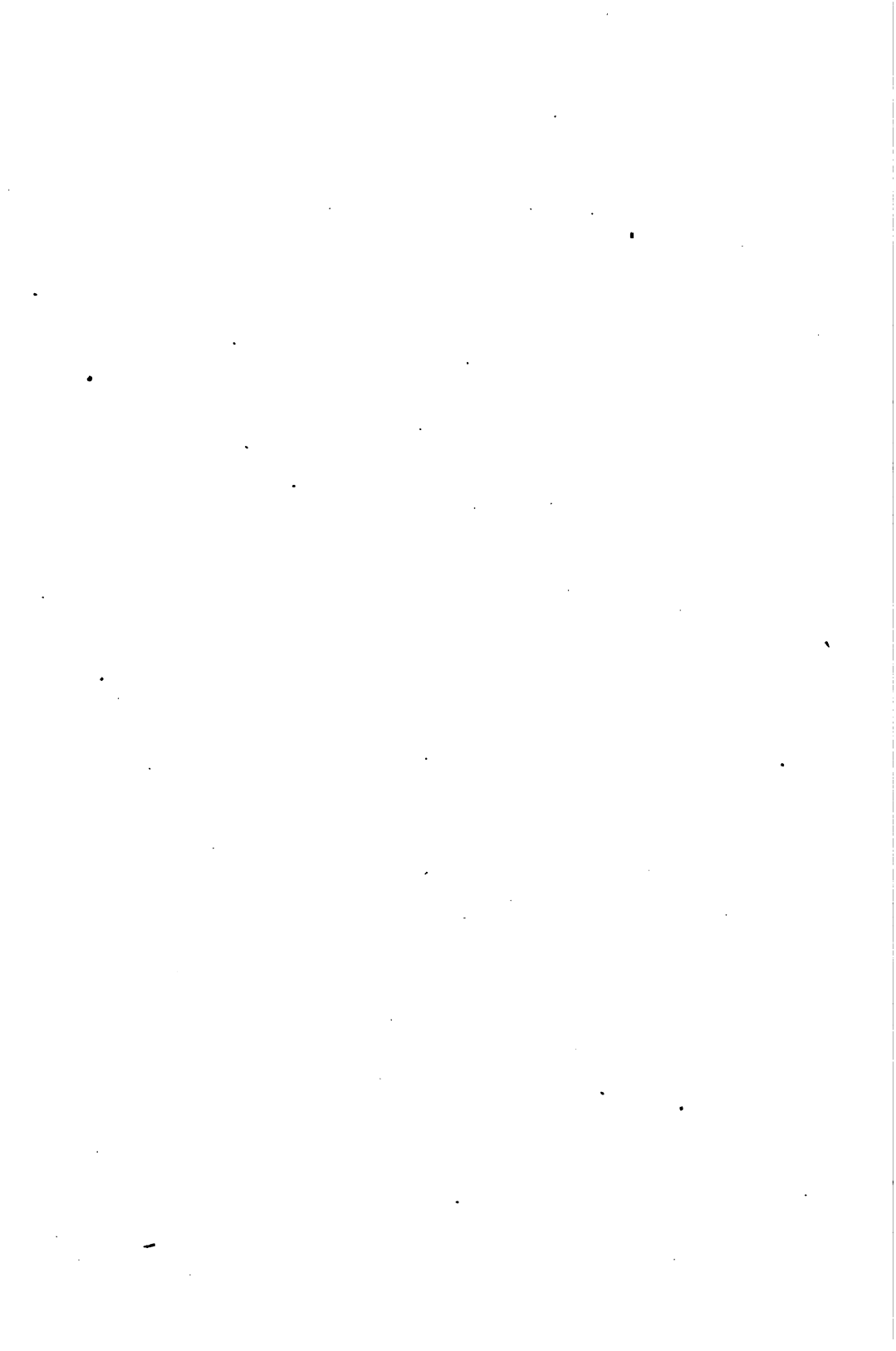
Greenock has a Hopper dredge, and Belfast was giving a contract for one while I was there. These have not to go so far with their dredged material as the Hopper barges, which have to go 15 to 25 miles or more. The Hopper dredges are by some considered more economical; I should, however, doubt that, and believe the Hopper barge is the cheapest in the long run.

So far as I could see, I do not think that we have much to learn regarding dredging and deepening of the St. Lawrence channel. I was most courteously received by all the members and staff of the Glasgow and Greenock Boards. These trusts are conducted very

similarly to our own, but Glasgow, from its importance, has a larger number of representatives.

I might here refer to Mr. Kennedy's report, appended hereto, for full information as to the channel operations for the past year. He has been sent by the Board to Great Britain and the Continent to procure steel castings, by which he expects largely to increase the capacity and work of the dredges at Cap La Roche, &c., as well as to cause greater economy in working, as it is well-known this is the crucial point in our deepened channel; he is straining every nerve to have it carried through at the earliest possible moment. * * * *





The following is a short account of the principal Dredges that have been used in deepening the Ship Channel between Montreal and Quebec :—

Elevator Dredge No. 1.—The first dredge machinery known to have been used on the St. Lawrence between Montreal and Quebec, and probably the first that was brought into Canada, arrived in Montreal about the 1st July, 1832. In the early part of 1830, the Legislature made an appropriation of £3,000 for the purpose of procuring a dredging vessel for the rivers and harbours of the Province. Sir James Kent, then Governor, communicated with the Harbour Commissioners in 1830, entrusting to them the commission of purchasing said vessel. The Commissioners made extensive inquiries respecting it; first, as to the practicability of obtaining it in Montreal, where they found it could not be constructed advantageously; next, as to getting it from New York, where they found it could be procured, but having found that the American dredges were much inferior to those of Great Britain, they turned their attention to purchasing it there. They entered into correspondence with Gillespie, Moffat, Finlay & Co., of London, who received estimates and specifications from different builders of machinery, viz.: Claude, Girwood & Co., of Glasgow; The Butterly Iron Works, Messrs. Boulton & Watt, and Messrs. Barnes & Millar. The contract was finally given to Claude, Girwood & Co. for engine and dredging machinery complete, exclusive of anchors and mooring chains, for £2,800 Stg., delivered at the Broomielaw. This engine and machinery was received in Montreal, per brig "Amity," about the 1st July, 1832, and was carted to and stored in a temporary building at the "Cross," near the guard house. The cost of the engine and machinery, including freight, exchange, &c., and a temporary building at £42; cartage to "Cross," £31; engineer, labourers, and other contingencies, £103, was £4,281 currency. The machinery consisted of a side lever condensing engine of 20-horse power, an iron boiler, the buckets, and the necessary driving gear, and was calculated to work to a depth of 16 feet. It was not used nor put into a hull until the spring of 1840. A dredge vessel, which was scow-shaped, and had the well open through to the stern, where the dredgings were delivered, instead

of at the side by a chute, and which was also fitted with paddle-wheels, was built in the winter of 1839-40 by David Vaughan, at the contract price of £1,975 currency. The machinery was put into this vessel and fitted up during the summer of 1840, under the supervision of James Dunbar, being placed at the fore end of the vessel, and connected to the upper tumbler at the after end by a long shaft and gearing, and the dredge was put to work on Sept. 12th near the Island Wharf. The bottom was stony, and the dredge was found incapable of doing much work. During the winter of 1840-41, rather extensive alterations were made, and additional machinery added for the purpose of working the winches and moving the dredge over the bottom by steam instead of by manual labour. She was, in the season of 1841, found still quite inadequate to the task required of her. She continued working, however, during the season; repairs and improvements were made from time to time, and the paddle-wheels being found unable to propel her and being an incumbrance, were removed. Eight of her buckets were broken in the summer of 1842. There was room for thirty-four on the chain, but she was worked with twenty-one, seven of which were provided with teeth. This dredge continued to work in the harbour of Montreal every summer, under yearly loan to the Harbour Commissioners by the Government, until the close of the season of 1849, when it was decided not to work her the next year, and she was sent to winter quarters at Sorel as usual, but was closed up and put in care of Messrs. J. & D. McCarthy for safe-keeping. She was conveyed by the Government to the Harbour Commissioners in 1851, they having been entrusted with the deepening of the channel, and was put to work at Ile Platte (Lavaltrie Channel) and continued in use in the ship channel. Her hull was lengthened in 1854, and a new hull, at £2,800 currency, was built for the machinery in 1856-7 by the Messrs. McCarthy, of Sorel. This hull was of the modern barge shape, with bow and stern alike, and the dredgings were delivered at the side by a chute. The machinery having been fitted up, the dredge was again put to work, beginning at Pointe aux Trembles (*en haut*) 1st July, 1857. She was used at various places in deepening the ship channel up to the end of the summer of 1881. The hull being unfit for further use

was broken up in October, 1882, the machinery having been removed, still in good repair, but not suited to the most efficient dredges of the present times.

Elevator Dredge No. 2.—The engines of this dredge were built in Montreal by Ward & Brush, about the year 1843, for the Board of Works. The links and buckets were made by Hedge & Bonner, of Montreal. The hull, which was also built here, was of wood and barge shaped. She was fitted with a pair of vertical condensing engines, coupled by gearing, and also geared directly to the upper tumbler, both engines and tumbler being in the after end of the vessel. She had a single wooden bucket-frame (ladder) and set of boiler-plate buckets without teeth and of about four cubic feet capacity. The winches were worked from the main engines, and fitted for working a bow chain and two thwart chains on each side. When first built the dredge was sent to Lake St. Peter, and employed there by the Board of Works during their operations in the straight channel. She was conveyed to the Harbour Commissioners in 1851, and used on Lake St. Peter in their work there. The hull was lengthened in 1855, and the dredge was conveyed to John Brown, Esq., in an exchange of plant, which took place between him and the Harbour Commissioners in 1866.

Elevator Dredge, No. 3.—This dredge, a sister vessel to No. 2, was built about the same time, and by the same parties, also for the Board of Works, and was used like No. 2 in Lake St. Peter, and conveyed to the Harbour Commissioners in 1851. She was lengthened in 1854, and in 1869 was rebuilt, getting a new hull. She was used in the ship channel improvements until the completion of the 25-foot channel in 1882, and is still the property of the Harbour Commissioners.

Elevator Dredge, No. 4.—The machinery of this dredge was ordered by the Harbour Commissioners from Murdock, Aitken & Co., of Glasgow, and was received in Montreal in August, 1854. The cost in Glasgow was £2,755 sterling. The engine was a side lever condensing engine of 25-horse power. The hull, which was of wood and barge shaped, was built by D. & J. McCarthy, of Sorel, for £2,450 currency. This dredge was of the same pattern as No. 1, with barge shaped hull; the engines

being placed in the fore end of the vessel, and connected by shafting and gearing to the upper tumbler at the after end. She was used by the Harbour Commissioners in the lake and river until 1866, when she was conveyed to John Brown, Esq., in the exchange of plant which then took place.

Elevator Dredges, Nos. 8, 9, 10, 11, 12.—The machinery of these dredges was built in Montreal, in 1874. Each dredge is fitted with two coupled, vertical, direct acting, condensing engines, placed in the after end of the vessel, and with a single wooden bucket frame. The winches for working the bow chain and breasting chains are furnished with independent double cylinder reversing engines, and when built each dredge had a set of boiler plate buckets of about four cubic feet capacity. The buckets of No. 10 have since been improved and strengthened, and those of the other four have been replaced. The hulls, which were built in Quebec, are of wood and barge shaped. They are still in use in the ship channel improvements.

Nos. 8 and 12 were much altered and furnished with buckets of sixteen cubic feet capacity in the spring of 1879.

No. 9 was altered, enabling her to dig to a greater depth, and furnished with buckets of one cubic yard capacity in the spring of 1884.

No. 11 was altered, enabling her to dig to a greater depth, and furnished with new and very strong cast steel buckets for rock dredging, in the spring of 1884.

Elevator Dredge, No. 13.—The machinery of this dredge was built in Chicago in 1874, and the hull was built in Quebec. She is similar to Nos. 8, 9, 10 11, and 12, and is still in use in the ship channel improvements. Like No. 11, she was altered in the spring of 1884, and furnished with cast steel buckets for rock dredging.

The following table gives some details of the dredging plant employed in deepening the ship channel between Montreal and Quebec in 1881, and with slight variations, it applies to the plant employed throughout the dredging to 25 feet depth :—

DREDGING PLANT employed in Deepening the SHIP CHANNEL between Montreal and Quebec in 1881.

DESCRIPTION OF VESSEL.		HULL.			ENGINES.					REMARKS.	
Length over all.	Breadth of Beam.	Depth of Hold.	When Built.	Tonnage Register.	Kind of Engines.	No. of Cylinders.	Diam. of Cylinder.	Length of Stroke.	Pressure of Steam.		
ft. in.	ft. in.	ft. in.	ft. in.				Inches.	Inches.	Lbs.	Capacity of Bucket.	Depth to which drawn.
										C. ft.	Feet.
DREDGES.											
Elevator Dredge No. 1	130 0	27 0	9 0	1832	Side lever condensing	1	27	30	5 to 7	4	24
" " " " No. 3	135 0	29 0	10 0	1845		2	30	48	20 to 25	4	24
" " " " No. 8	135 0	29 0	10 0	1874	Two coupled vertical direct acting condensing engines to each dredge.	2	20	32	35 to 60	16	35
" " " " No. 9	135 0	29 0	10 0	1874		2	20	32	35 to 60	4	35
" " " " No. 10	135 0	29 0	10 0	1874		2	20	32	35 to 60	4	35
" " " " No. 11	135 0	29 0	10 0	1874		2	20	32	35 to 60	4	35
" " " " No. 12	135 0	29 0	10 0	1874		2	20	32	35 to 60	16	35
" " " " No. 13	135 0	29 0	10 0	1874		2	20	32	35 to 60	4	35
STEAMERS AND TUGS.											
John Young	125 0	22 0	8 1	1875	Independ't beam. Condensing.	2	30	16	45 to 50		
M. F. Parsons	76 0	15 0	6 6	1864		1	18½	20	80 to 90		
St. Francis	80 0	17 0	7 9	1875		1	20	22	80 to 87		
St. John	80 0	17 0	7 9	1875	Vertical non-condensing.	1	14	16	70 to 80		
John Pratt	96 0	19 2	7 3	1874		2	18	20	70 to 80		
Delisle	62 5	14 9	7 5	1869		1	18	20	80 to 90		
John Brown	76 0	15 0	7 0	1857		1	18	20	70 to 80		
C. J. Bridges	62 2	16 0	8 0	1874		1	20	22	70 to 80		
St. James	76 0	17 0	8 2	1875	Vertical compound	2	14 & 28	20	70 to 80		
BARGES.											
Waverly	110 0	20 11	7 1	1870							
Dreadnaught	104 2	21 5	7 4	1869							
Henry Thomas	100 8	22 9	7 7	1865							
Hone	98 0	20 0	6 6	1864							
Caroline	103 8	22 6	8 3	1872							
Stone Lifter No. 1	65 0	22 0	6 0	1858	Steam Winch						
Stone Lifter No. 2	75 0	24 0	9 9	1878	Steam Winches						
SCOWS.											
					Capacity of each Scow.						
					Cubic Yards.						
2 Hopper-bottomed	80 0	16 0	7 0	1870							
8 "	80 0	16 0	6 9	1874							
2 "	54 6	18 0	7 0	1875	80						
2 "	58 0	19 9	7 8	1876	89						
2 "	89 0	18 0	7 9	1879	150						
2 "	89 0	18 0	7 9	1880	150						
3 Flat Scows											

Note.—Different Spoon Dredges belonging to the Montreal Harbour Works were, in addition to the above, temporarily employed on the Ship Channel.


DISTANCES

Between certain Commercial Centres in America, Asia and Europe, showing the advantages of the St. Lawrence route as to distances, in statute miles and percentages.

If a line be drawn from Toledo, at the south-eastern end of Lake Erie, to St. Louis, and thence in a south-westerly direction, passing through the eastern boundary of New Mexico, about two-thirds of the whole area of the United States will lie to the north-west of this line, and for this portion the St. Lawrence furnishes a shorter route to Europe than any route via New York. This being the general fact, a few examples of the advantages of the St. Lawrence route, in point of distance, are given by the following comparison of the distances between some of the leading points in Europe, America and Japan :—

FROM	TO	Statute miles	Difference in favor of St. Lawrence route. Statute miles.	N. York route. Per cent. longer than St. Lawrence route.
Yokohama (Japan) ..	San Francisco	5,152		2.2
"	Port Moody	5,042	110	
San Francisco	New York	3,320		14.5
Port Moody	Montreal	2,900	420	
New York	Liverpool	3,504		9.0
Montreal	"	3,216	288	
Yokohama (Japan) ..	Liverpool, via San Francisco and New York	11,976		7.3
" " ..	Liverpool, via Port Moody and Montreal	11,158	818	
Chicago	New York, via P. R. R.	912		9.6
"	Montreal, via C. & G. T. and G. T. R.	832	80	
"	Liverpool, via New York ..	4,416		9.1
"	" Montreal	4,048	368	
San Francisco	Liverpool, via Chicago and New York	6,824		5.7
"	Liverpool, via Chicago and Montreal	6,456	368	
Portland (Oregon) ...	New York, via Minneapolis and Chicago	3,234		9.6
" " ...	Montreal, via N. Pac., Sault Ste. Marie and Can. Pac. R.	2,950	284	
" " ...	Liverpool, via Minneapolis, Chicago and New York ..	6,738		9.3
" " ...	Liverpool, via Sault Ste. Marie and Montreal	6,166	572	
Minneapolis	New York, via Chicago	1,332		20.5
"	Montreal, via Sault Ste. Marie	1,105	227	
"	Liverpool, via Chicago and New York	4,836		11.9
"	Liverpool, via Sault Ste. Marie and Montreal	4,321	515	
Winnipeg	Liverpool, via Chicago and New York	5,278		13.5
"	Liverpool, via Can. Pac. R'y and Montreal	4,651	627	

The following are taken from the Report of the Board of Trade of Montreal, 1880-1882—distances reduced to statute miles:—

 With two exceptions, the distances in this table are measured through the English Channel. An asterisk (*) indicates the course to be round the North of Scotland. All the routes to Montreal are calculated via the Straits of Belle Isle. The information has been kindly furnished by E. Deville, Esq., Deputy Surveyor-General, Ottawa.

FROM	TO NEW YORK.	TO MONTREAL.	Difference in favor of the St. Lawrence route.	New York route per cent. longer than the St. Lawrence route.
Havre	3,608	3,395	213	6.3
Antwerp	3,827	3,608	219	6.1
Rotterdam	3,839	3,620	219	6.0
Hamburg	{ 4,150 *4,046	{ 3,931 *3,689	{ 219 357	{ 5.6 9.7
Christiania	3,994	*3,640	354	9.7
Bergen	3,735	3,366	369	11.0
Trondheim	3,838	3,424	414	12.1
South-west end of Scilly Isl'ds	3,320	3,101	219	7.1
North end of Orkney Islands.	3,424	3,066	358	12.0

GREAT CIRCLES OR AIR LINES,

As per Map of the Dominion of Canada published by order of the Hon. the Minister of the Interior, November 1st, 1878.—Distances reduced to statute miles.

FROM	To	Geo. Miles.	Statute Miles.
Yokohama (Japan)	Port Simpson	3,865	4,455
“	Port Moody (Burrard Inlet)	4,374	5,042
“	San Francisco	4,470	5,152
San Francisco	New York	2,228	2,568
“	Montreal	2,202	2,538
Burrard Inlet	“	1,992	2,296
Port Simpson	“	2,194	2,529
St. John (Newfoundland) ..	Cape Clear	1,670	1,925
“ ..	Tory Island	1,693	1,751
Montreal	Quebec (Riv. St. Lawrence) ..	139	160
“	Cape Race (via St. Paul) ..	1,007	1,161
“	Belle Isle	886	1,021
Belle Isle	Tory Island	1,657	1,910
Cape Race	“	1,736	2,001
“	Cape Clear	1,708	1,969
Tory Island	Liverpool	240	277
Cape Clear	“	310	357
Halifax	Cape Race	470	542
Portland	“	767	884
Boston	“	808	931
New York	“	1,010	1,164

DISTANCES

*Of places between Montreal and Quebec, measured along the
centre line of the Ship Channel.*

	English Statute Miles.	Nautical Miles.
Montreal, Island Wharf, opp. Custom House...	0	0
Longue Pointe	6 $\frac{1}{8}$	5 $\frac{3}{8}$
Pointe-aux-Trembles, en haut.....	10 $\frac{1}{8}$	8 $\frac{3}{8}$
Varennas	13 $\frac{1}{2}$	11 $\frac{1}{4}$
Cap St. Michel	15 $\frac{7}{8}$	13 $\frac{1}{4}$
Vercheres	21 $\frac{1}{4}$	19
Plum Island Light	22 $\frac{7}{8}$	19 $\frac{7}{8}$
Contrecoeur Channel, upper entrance	28 $\frac{1}{2}$	24 $\frac{1}{4}$
Lavaltrie	30	26
Contrecoeur Channel, lower end.....	36	31 $\frac{1}{8}$
Lanoraie.....	36 $\frac{1}{4}$	31 $\frac{1}{4}$
Sorel, opposite Light House	45	39
Isle de Grace Light	48 $\frac{1}{2}$	42 $\frac{1}{8}$
Stone Island Light.....	52	45 $\frac{1}{4}$
Light Ship No. 1	57 $\frac{1}{4}$	49 $\frac{3}{8}$
“ “ No. 2	60 $\frac{1}{8}$	52 $\frac{1}{8}$
White Buoy.....	64 $\frac{1}{2}$	56 $\frac{3}{8}$
Light Ship No. 3	71	61 $\frac{1}{4}$
Port St. Francis	75 $\frac{1}{4}$	65 $\frac{3}{8}$
Three Rivers.....	81 $\frac{7}{8}$	71
Becancour, Iron Buoy at Bend.....	87 $\frac{1}{4}$	75 $\frac{7}{8}$
Champlain	93 $\frac{1}{2}$	81 $\frac{3}{8}$
Batiscan Wharf	101 $\frac{1}{4}$	87 $\frac{1}{4}$
Cap Levrant	105 $\frac{1}{4}$	91 $\frac{3}{8}$
Cap la Roche, centre of new Channel.....	108	93 $\frac{3}{4}$
Cap Charles.....	110 $\frac{1}{2}$	96 $\frac{3}{8}$
Richelieu Rapids	120	104 $\frac{1}{4}$
Platon Wharf	124 $\frac{7}{8}$	108 $\frac{3}{8}$
St. Croix.....	130 $\frac{1}{2}$	113 $\frac{3}{8}$
Ecureuil	132	114 $\frac{3}{8}$
Pointe-aux-Trembles, en bas.....	139	120 $\frac{1}{4}$
Cap Rouge.....	151	131 $\frac{1}{4}$
Quebec, Custom House Wharf.....	160	139

SHIP CHANNEL DREDGING,

UP TO THE OPENING OF THE 25-FOOT CHANNEL.

Distance from Montreal to Quebec, 160 English statute miles.

Dredging for the ship channel begun in the straight channel in Lake St. Peter in 1844, suspended in 1847. Straight channel subsequently abandoned.

Dredging begun in the present ship channel in 1851 and continued to 1869.

Dredging resumed in 1875 to attain 25 feet depth.

Depth of ship channel at low water before dredging..	10 feet. 6 inches.
Increase of depth effected up to 1869 (see page 286)..	9 "
Depth attained in 1869 (see page 286).....	20 "
Depth attained in 1878	22 "
Depth attained in 1882	25 "
Expenditure for 20 feet depth (exclusive of the abandoned channel).....	\$1,164,366
Additional expenditure for 25 feet depth.....	1,780,000

PLACES AT WHICH DREDGING HAS BEEN DONE.

		Length of dredging in English miles.
25 FOOT CHANNEL.		
Montreal Harbour	Gravel and sand .....	.90
Hochelaga	Stones and gravel .....	.22
Pointe aux Trembles channel.....	Clay and boulders.....	3.15
Poulier Varennes—opposite Varennes	Clay and boulders.....	.15
Varennes to Cap St. Michel.....	Clay and boulders.....	1.20
Curve at Cap St. Michel.....	Clay and boulders.....	1.35
Pointe Marie	Clay and boulders.....	.47
Vercheres	Clay and boulders.....	.05
Plum Island.....	Clay and boulders.....	.22
Contrecoeur channel—upper entrance.	Clay and a few boulders ..	.51
“ “ main portion...	Clay and a few boulders ..	3.10
“ “ Ile St. Ours.....	Hard Silt and clay .....	.85
Ile de Grace	Sand and some clay .....	.50
Lake St. Peter, including Nicolet Tra- verse	Chiefly soft clay.....	17.47
Port St. Francis.....	Hard pan and boulders ..	.22
Becancour Traverse and Bend.....	Hard pan and boulders ..	.32
Champlain Village	Clay and boulders.....	.35
Point Citrouille	Coarse sand .....	.25
St. Ann's Shoal and Cap Levrant.....	Tough clay and boulders ..	1.47
Cap la Roche	Shale rock and boulders ..	.93
Poulier Rayer.....	Boulders and clay .....	.17
Cap Charles	Shale rock and boulders ..	.40
Total for 25 feet channel.....		34.25
20 FOOT CHANNEL.		
Lavaltrie channel.....	Clay and boulders.....	5.00
Total length dredged.....		39.25

In the straight parts of the channel, between No. 1 lightship and the white buoy, Lake St. Peter, the dredging is 325 feet wide; in the straight parts elsewhere it is generally 300 feet wide, but in bends and all important places it is widened out to 450 feet or more. At all places above Cap la Roche the depth of the dredged channel is 25 feet at low water, and at Cap la Roche and Cap Charles it is 25 feet deep with a good average tide. In the Lavaltrie channel—which is independent of the 25 foot channel—the depth is 20 feet at low water.

PLANT EMPLOYED.

Eight elevator dredges (single set of buckets, endless chains).

Two spoon dredges (employed part of time).

Two boulder grappling barges.

Nine tug boats.

Five coal tenders.

Nineteen hopper scows, 80 to 90 cubic yards capacity.

Four hopper scows, 150 cubic yards capacity.

Daily capacity of dredges varies with the nature of work, from 150 cubic yards shale to 4,000 cubic yards soft clay.

QUANTITIES DREDGED.

From the nature of the work the quantities dredged in excavating the ship channel in the St. Lawrence to the depth of 25 feet are not known exactly, but a close approximation is obtainable. By admeasurement in excavation, T. C. Keefer, C.E., found the quantity excavated to attain $16\frac{1}{2}$ feet depth to be 1,379,911 cubic yards (see page 249.) In deepening from $16\frac{1}{2}$ feet depth to 20 feet depth, it is estimated there was excavated 3,000,000 cubic yards. To attain 25 feet depth there was an additional quantity of 8,509,793 cubic yards excavated, making a total for the 25 foot channel of 12,889,704 cubic yards.

In order to realize more fully the the magnitude of the work done, for the comparatively small outlay, it may be useful to compare it with some works on land where the results are visible and more easily comprehended.

On the North Shore Railway, for instance, between Montreal and Quebec, of 172 miles in length, the total quantity of excavation is 3,060,853 cubic yards.

On the prairie section of the Canadian Pacific Railway, west from Winnipeg, the quantities of excavation are an average of 16,300 cubic yards per mile.

In the 25-foot channel the quantity of excavation is therefore somewhat more than four times that on the North Shore Railway between Montreal and Quebec, and equal to the excavation on the Canadian Pacific Railway for 791 miles west from Winnipeg.

By this excavation the ship channel in the St. Lawrence has been deepened from an available depth of 10 feet 6 inches in 1851 to a depth of 25 feet in 1882, at a total cost of \$2,944,365.91, including plant, which cost \$534,809.65. Allowing one-third for depreciation from wear and decay, which is sufficient, as the plant has been kept in a good state of repair, its value in 1882 was equal to \$356,539.77 for the further deepening of the channel, thus reducing the total cost of the 25-foot channel to \$2,587,826.15. Regarding the amount of work done, the circumstances under which it has been done and its cost, the execution of the improvements in the ship channel of the St. Lawrence, in point of economy, will compare favourably with that of any other public work, and the advantages arising from the improvements will compare no less favourably with the benefits derived from any other work. At the original depth of about 10 feet 6 inches as low water, which was not increased until the year 1851, vessels of 250 tons burden could not pass Lake St. Peter with a full cargo, and the class of vessels suitable to the trade about the year 1840 were vessels of about 350 tons to 400 tons burden, which, when fully loaded, generally drew about 16 feet of water. These, at a draft of 10 feet 6 inches, could carry little or no cargo, being scarcely able to stand upright, and it was therefore impracticable for them to run in the St. Lawrence trade during the time of low water.

Accompanying the available improvements in the ship channel begun in 1851, the ocean ships visiting Montreal have increased rapidly in size and number. The first ocean mail steamship between England and Montreal, the "Genova," of about 600 tons

burden, arrived in port in 1853, and since that time the growth of commerce on the St. Lawrence has been such, that in 1882 there were twenty regular lines of ocean steamships, besides transient vessels, successfully engaged in the St. Lawrence trade. Amongst the ships of the regular lines are some of the largest and finest passenger steamers afloat, as for instance the *Parisian* of 450 ft. length and a gross tonnage of 5,359 tons, and the *Vancouver* of 441 ft. length and 5,217 tons gross. The yearly tonnage of the port of Montreal increased from about 358,000 tons in 1851 to 1,672,651 tons in 1880.

Notwithstanding the great improvements effected in the ship channel in the St. Lawrence, the trade yet requires further improvements. The largest vessels, when fully loaded, draw more than 25 feet of water, and these are subject to delay and expense at the lowest water in autumn, when despatch is of most importance. Not only do the present wants urge further improvements, but the certain large increase of trade *via* the St. Lawrence in the near future renders it the more necessary.

To meet this necessity the Harbour Commissioners were in the spring of 1883 authorized by the Dominion Government to deepen the ship channel between Montreal and Quebec to 27½ feet at low water. Operations were at once commenced with a fleet of eight powerful dredges, two stone lifters, six tugs, and the necessary tenders. The work is now (1884) in full progress and will be continued vigorously until its completion, which probably will be in the fall of 1887.

GENERAL INDEX.

- Advantages, see "Deepening."
 "Alliance," Str 232-3
 Appropriations, see "Grants."
 A Public Work, see "Deepening."
 Bottom of Lake St. Peter, Nature of, 20-1, 77-8, 115, 118, 121, 141, 184 to
 187, 194-5, 199, 206, 211 to 216, 236, 238
 "California," ship 231 to 234
 "Campbell," ship, see "James Campbell."
CHANNELS :
 Old or Natural, Description of..... 17, 120
 Straight, Description of..... 60, 167
 Compared, Natural with Straight, 120, 123-4, 128, 134, 136, 142-3,
 146, 150 to 154, 159, 165 to 173, 176, 179 to 182, 195, 201, 204 to
 206, 225, 238, 245 to 250
 Choice of, Recommendations, &c., 59, 64, 66 to 71, 73 to 81, 83 to 89,
 93, 103 to 105
 Natural Channel Recommended..... 59 to 62, 89, 91, 113, 209
 Straight Channel Adopted..... 57
 Straight Channel, tests of dredging in..... 92, 114, 115
 Between the Islands, closing..... 60, 76
 Straight Channel Abandoned..... 193, 209, 217
 Currents in the Channels, 5, 6, 20, 67, 75, 86, 89, 116, 123, 128-9, 139,
 146, 167, 180, 186, 200, 202, 203, 216, 235, 237
 Natural Channel adopted..... 209, 217
 Natural Channel, tests of dredging in, 217, 218, 226, 230 to 234, 240,
 285, 294 to 296, 297
 Filling in of Dredged Channel, see "Filling in."
 Charts of Lake St. Peter..... 21, 59, 106, 130, 138
 "City of Manchester," ship..... 217
 Clyde Improvements..... 29, 206, 254, 257, 325, 326
 Commissions of Inquiry..... 24, 97, 101, 194-5, 197
 Commissioners, Harbour..... 197, 217
 Control of Work Changed..... 182, 197
 Cost of Dredging..... 217, 247 to 250, 303-4, 309 to 315, 320 to 226, 337-8
 Cost of Outfit 102, 191, 247 to 250, 309 to 315, 316, 338

DEEPENING OF THE SHIP CHANNEL :

A Public Work, 56, 81-2, 101, 123, 129, 152-3, 164, 210, 219 to 221, 230-1, 258 to 260, 262, 266, 279, 280, 285-6, 299, 303 to 307, 310 to 315, 319, 321, 325	
Advantages of, 32 to 53, 56, 222-3, 261, 263, 277 to 279, 285-6, 303, 318, 319	
Practicability of.....	2, 9, 13, 15, 17, 19, 20, 23, 235, 316 to 319
Tenders for, by Thos. Porteous.....	2, 29
To 14 feet at low water.....	9, 13
Recommended.....	29
Straight Channel, selection of.....	57
Begun in Straight Channel.....	58
Suspended in Straight Channel.....	155-6
Resumed in Straight Channel.....	165, 174-5
Stopped in Straight Channel.....	193
Control of Work Changed.....	182, 197
Natural Channel, selection of.....	197
Begun in Natural Channel.....	217
Two Feet Accomplished.....	219
Four Feet Accomplished.....	230 to 234, 241
To 16½ Feet at Low Water Accomplished.....	234
To 20 " " " ".....	285
To 25 " " " Resolved on.....	285-6
To 22½ " " " Accomplished.....	294 to 296
To 25 " " " ".....	297 to 301, 313
To 27½ " " " Agitated.....	301, 307 to 325
To 27½ " " " Begun.....	301, 325-6
Depth of Water in Lake and Channel, 5, 7, 23, 61, 91-2, 114, 117-8, 136, 140, 142, 151, 166 to 173, 180, 182 to 191, 201, 236, 238, 285, 297, 310	
Draught of Vessels.....	23, 32 to 52, 222, 231, 242
Dredges, tests of, &c.....	15, 16, 17, 20, 64, 184, 227, 229, 291, 293
Dredging, modes of.....	243 to 247
Dues, tonnage.....	29, 56, 219, 220, 256
Dykes.....	5, 6, 7, 60, 204

ESTIMATE BY

Atherton. Chas., C.E.....	62
Bayfield, Capt.....	139
Board of Works.....	94 to 96
Board of Engineers, 31st Oct., 1850.....	208 to 210
Boxer, Capt.....	126
Boxer, Capt.....	130
Commissioners of Inquiry.....	97 to 101
Commissioners of Public Works, 12th July, 1847.....	183

ESTIMATE BY

Committee Select.....	107 to 112
Committee Select, 17th July, 1847.....	180-1
Gzowski, C. S., Cost of Dredging, &c., 18th Dec., 1852.....	225
Harbor Commissioners, of cost of dredging, Dec. 27th, 1852, 217, 218	
Killaly, Hon. H. H.....	138
Killaly, Hon. H. H.....	143 to 145
Keefer, T. C., 1st March, 1855.....	238 to 260
Kennedy, John, 25th January, 1882.....	307 to 309, 323-4
Nish, A. G., deepening to 24 feet.....	287
Rubidge, F. P., 31st May, 1847.....	184 to 191
Thompson, David, C.E.....	54
Evidence, Minutes of.....	4 to 7, 19 to 21, 31 to 55, 114 to 151

EXPENDITURE:

General Statement of, in Straight Channel, 1841 to Dec. 1845....	102
“ “ “ “ 1841 to 1846..	191
Dredging in Present Channel, 1851-2.....	224-5
General Statement of, in Present Channel, 1880.....	303-4
“ “ “ “ 1883.....	320 to 323
Filling in of the Dredged Channel, Opinions on, 4 to 9, 13, 17, 19 to 21, 75 to 77, 89, 93, 108, 121, 141, 166-7, 180-1, 186-7, 193-4, 202-3, 205 211 to 216, 236 to 238, 318	
Flats of Lake St. Peter.....	61, 233, 236
Freights.....	3, 33
Fund, Raising a.....	27
Grants.....	24, 55-6, 155
Grants, Raising a Fund.....	27
Groins.....	71, 79, 80, 84, 142, 204, 210
Growth of Trade.....	3, 32 to 53, 262, 272, 278-9, 286-7
Harbour Commissioners of Montreal.....	56, 197, 217
Ice, action of.....	21, 76, 237
Improvement of Lake St. Peter, see “ Deepening.”	
Investigations, see “ Committees,” “ Commissions,” “ Evidence.”	
“ James Campbell,” ship.....	92, 105, 114 to 116, 120

LETTERS :

Armstrong, Jas., to Sec. Daly, 4th Aug., 1845.....	90
Bayfield, Capt., to Mr. Killaly, 12th Feb., 1844.....	67
Bayfield, Capt., to Mr. Killaly, 1st June, 1844.....	70
Bayfield, Capt., to Mr. Killaly, 3rd March, 1845.....	80
Beaufort, Capt., to Captain Bayfield.....	71
Beecher, Capt., to Mr. Killaly, 1st March, 1845	79
Begley, T. A., to Mr. Atherton, 20th Oct., 1843.....	64
Begley, T. A., to Sec. Daly, 18th June, 1846.....	157
Boxer, Capt., to Capt. Higginson, Civil Sec.....	125
Boxer, Capt., to Capt. Higginson, Civil Sec., 4th June, 1845.....	130

LETTERS :

Bulmer, H. (Acting Chairman), to Hon. H. L. Langevin, 1st Dec., 1880.....	301
Daly, Sec., to Hon. George Moffat, Chairman of Committee, 25th June, 1841.....	25
Daly, D., Sec., to Hon. W. B. Robinson, 22nd Sept., 1846.....	175
Douglass, Capt., to Capt. Vaughn, 17th Feb., 1844.....	70
Glass, John, Sec. Har. Com., to A. N. Morin, Prov. Secretary, 27th Dec., 1852.....	217
Grey, Lord, to Earl Cathcart, Gov.-Gen., 28th July, 1846.....	162
Harbor Commissioners to Board of Engineers, 22nd Oct., 1850..	197
Harbor Commissioners to Board of Engineers, 9th Nov., 1857..	261
Killaly, H. H., to Capt. Bayfield, 25th Jan., 1844.....	65
Killaly, H. H., to Capt. Bayfield, 20th Nov. 1844.....	72
Killaly, H. H., to Provincial Secretary, 30th May, 1846.....	155
Killaly, H. H., to Provincial Secretary, 8th June, 1846....	156
Killaly, H. H., to E. Parent, 23rd June, 1846.....	158
Killaly, H. H., to E. Parent, 24th June, 1846.....	159
Parent, E., to Provincial Secretary, 24th June, 1846.....	161
Rendell, J. M., to Capt. Beaufort, 16th Feb., 1845.....	80
Routh, Sir. R. J., to Hon. George Moffat, Chairman of Committee, 4th Aug., 1841	53
Sandom, Capt., to Hon. Geo. Moffat, Chairman of Committee, 2nd Aug., 1841.....	52
Ward, F. H., to Governor-General, 25th July, 1846.....	162
Lighterage, Cost of, &c.....	27, 30, 32 to 52, 114, 156, 219, 220, 222, 261
Loans.....	288, 313, 322, 325
Low Water.....	33, 61, 219, 281, 285
Manchester, ship, see "City of Manchester."	

MEMORIALS :

Harbor Commissioners to Government, Dec., 1880.....	302
" " " " Nov., 1882.....	310
Modes of Dredging, see "Dredging."	

NEWSPAPER EXTRACTS :

"Pilot," of 2nd September, 1845.....	88
"Montreal Gazette," of 9th October, 1845.....	91
"Mirror of Parliament," of 15th May, 1846.....	103
" " of 5th June, 1846.....	151
"Pilot and Journal of Commerce," 1st Sept., 1846.....	163
"Quebec Gazette," Sept., 1846.....	176
"Pilot," 26th Sept., 1846.....	176
"Quebec Mercury," 17th July, 1847.....	192
"Quebec Gazette," 23rd July, 1847.....	192
"Quebec Mercury," 12th August, 1847.....	192

Officers, Duty of.....	146-7
" Ocean," Ship.....	285-6

PETITIONS OF

Armstrong, C. L., 5th April, 1845.....	88
Board of Trade of Montreal, 1838.....	23
" " " 1841.....	26, 56
" " " 1st Sept., 1846.....	163
Merchants of Montreal, 1826.....	1
" " 1827.....	8
" " 1836.....	18
Pilots (circulated by Capt. Vaughan) Winter of 1844-45.....	134-5
"Peruvian," SS.....	297-8
Plant.....	63, 76, 79, 153, 156, 288 to 293, 299, 303, 309, 311, 316

REPORTS BY

Atherton, Chas., C.E., On Proposed Proceedings in Lake St. Peter, Aug., 1843.....	59
Bayfield, Capt. W. H., on Lake St. Peter Geographical and Geological, 1831.....	14
Bayfield, Capt. W. H., on Channels, 17th Sept., 1846.....	165
Board of Works, 1841.....	56
" " 1843.....	63
" " 1844.....	83
" " 1846.....	93
By, Colonel, on Report of Committee, 1827.. . . .	13
Childe, McAlpine & Kirkwood, 24th March, 1858.....	264 to 279
Commissions of Inquiry into the Management of the Board of Works, 22nd May, 1846.....	97
Commissioners of Public Works, 22nd July, 1847.....	182
" " " 18th October, 1848.....	194
Committee on the Navigation of Lake St. Peter, 1826.....	3
" " " " 1827.....	9
Committee, Select, to Report on the Report of of the Board of Works, 1st June, 1846.....	106
Committee of Executive Council, 24th June, 1846.....	161
" " " 21st Sept., 1846.....	174
Committee, Select, of the House, 17th July, 1847.....	179
Gzowski, C. S., on Ship Channel and Harbour, 18th Dec., 1852.....	223 to 226
Keefer, T. C., on Deepening to 27½ feet, 25th Jan., 1883.....	315
Keefer, T. C., on Ship Channel and 20 feet Channel, &c., 1st March, 1855.....	235 to 260
Keefer, T. C., on Ship Channel, 25th Oct., 1853.....	242
Kennedy, John, C.E., for the year 1875.....	289
" " " 1878.....	294
" " " 1882.....	297
" " on Deepening to 27½ feet, 25th Jan., 1882.....	307

REPORTS BY—Continued.

Logan, Sir W. E., 30th Oct., 1850.....	212 to 216
McNiel, Childe & Gzowski, 31st Oct., 1850.....	199 to 210
Orlebar, Col., 29th Feb., 1860.....	279 to 285
Rubidge, F. P., on Straight Channel, 31st May, 1847.....	183
Special Committee of 1841.....	26
Quantities Dredged.....	224, 227, 245 to 249, 251
SURVEY and Soundings of Lake St. Peter and River St. Lawrence by	
Bayfield, Capt., 1830.....	19, 21, 22
“ “ 1846.....	165 to 173, 201
Board of Works.....	89
Board of Engineers, 31st Oct., 1850.....	201
Boxer, Captain.....	125-6
“ “.....	130-1
Committee of Merchants, 1825.....	2
“ “ 1826.....	10, 11
Committee, Select, June, 1846.....	106-7
Keefer, T. C., 1855.....	245, 251
Keefer & Vaughan, 1846.....	94
Kennedy, John, 1882.....	308
McKim, Capt., 1847.....	201
Rubidge, Capt. (referred to 1847).....	186-7
Rubidge, Capt., 1848.....	196, 201
Vaughan, Capt.....	137
St. Lawrence Route, Advantages of.....	262-3, 271 to 279
Salaries.....	146-7, 153
Ship, “James Campbell”.....	15, 92, 114 to 116, 120
Ship, “California”.....	231 to 234
Ship “Ocean”.....	285-6
SS. “Peruvian”.....	297-8
Tests, see “Channels” and “Dredges.”	
Tonnage Dues, see “Dues.”	
Tonnage of Vessels.....	233
Upper Canada, Trade of.....	2, 29
Upper Canada, Deep Cut on Welland Canal.....	153

INDEX TO NAMES.

Abraham, Robt.....	234
Aitken & Co.....	46
Allan, Andrew.....	
Alleyn, C.....	279
Armstrong, Capt. C. L....	88, 90, 103-4, 109, 122, 127, 194, 199, 234, 280, 296
Armstrong, James.....	90, 103, 152
Armstrong, John.....	102, 234
Armstrong, J. D.....	112, 150, 151
Armstrong, D. M., M.P.P.....	194
Atherton, Chas., C.E., 57, 64, 89, 109, 115, 122, 124, 132, 142, 144 to 147, 197, 198	
Atwater, E.....	x, xiii
Auger, J. B. & Son.....	290
Aylmer, Lord.....	14, 18
Baldwin, Mr. M.P.P.....	154
Bartley, W. P. & Co.....	290
Bayfield, Captain Henry W., 14, 18, 19, 57, 65, 67, 69, 70, 72, 80, 81, 83-4, 87, 99, 106, 108, 109, 113, 119, 126, 137, 139, 145, 148-9, 159, 161 to 163, 165, 173 to 182, 198, 200, 201, 203-4, 215	
Beaudreau, Zephrein, Pilot.....	115
Beaudry, Hon. J. L.....	296
Beaufort, Capt.....	71 to 75, 77 to 79, 80, 84, 86, 113, 137, 148-9
Becher, Capt.	79
Begley, T. A., Sec. Board of Works.....	57, 131, 133, 148, 192, 193
Belmare, H.....	234
Bell, Capt.....	223, 226, 229, 233 to 235, 243 to 245
Bellhouse, David.....	234
Bernard, Dr. A.....	299
Berthelot, J. A.....	x, xii
Bouillie, David, Pilot.....	198
Boxer, Capt.....	74, 81, 103, 109, 111, 122, 124, 127, 130, 131, 138, 198
Boyer, Jos., Pilot.....	134
Boyer, David, Pilot.....	135
Brown, John.....	329-30
Buchanan, Cunningham & Glass.....	38
Bulmer, Henry.....	302, 306
By, Colonel.....	9, 13

Cameron, M.....	195
Cathcart, Earl.....	163, 173
Cartier, Sir Geo. E.....	x, xii
Cartier & Cowan.....	102
Cass, John.....	147
Cayley, Mr.....	103
Chalmers, W. T.....	96
Childe, John, C.E.....	197-8, 211, 263
Coats, John.....	13
Colborne, J. (Administrator).....	22, 25
Cote, Pierre, Pilot.....	104, 109, 115, 122-3
Coursol, C. J. (Mayor).....	287
Cramp, Thomas.....	295, 299
Cringan, Thomas.....	x, xii
Cuvillier, Austin.....	18, 23
Daly, Hon. D.....	25, 26, 90, 165
Davis, Theodore.....	4
Defoy, Capt. Jos.....	4, 6
Delisle, A. M.....	299
Denham, Capt.....	72
Denville, E., Esq., Deputy Surveyor-General.....	333
DeWitt.....	18
Donovan, Peter.....	xi, xiii, xiv
Dougal, Irvine & Co.....	49
Douglas, Capt.....	57, 70, 83, 89
Doutre, Leon.....	234
Draper, Mr. M.P.P.....	154
Dubord, Capt.....	194
Duffil, J.....	96
Dumont, Mr.....	14
Dunbar, Jas.....	328
Ferres, James Moir.....	122, 149
Flemming, Wm.....	147
Forsyth, Robert.....	265
Forsyth, Richardson & Co.....	46
Gagnon, Pierre, Pilot.....	295
Gall, Capt.....	231 to 234
Gillespie, Moffat, Jamieson & Co.....	43
Gilmour & Co.....	50
Glass, John.....	217, 221, 223, 226, 235
Gosford, Gov. in Chief.....	21, 22
Gould, Chas. H.....	xi, xiii, xiv
Greenfield, Jas.....	13
Grey, Lord.....	163
Gzowski, S., C.E.....	197-8, 221, 223, 226

Hall, Wm., Col. of Customs.....	51, 95
Hamelin, Hector, Pilot.....	104, 109, 122-3, 234
Hancock, Commander.....	280
Hays, M. J.....	101, 104, 122, 129
Hedge & Bonner.....	329
Heney, Mr.....	3
Higginson, Capt.....	125, 129, 130
Hingston, Dr. W. H.....	xi, xiv
Holloway, Col.....	125
Holton, Hon. L. H.....	x, xii, xiv
Hood, David.....	148
Hudon, Victor.....	xi, xiii, xiv
Hunter, Wm.....	58, 121, 122, 129, 147-8
Jackson, Sir Richard.....	147, 158
Johnston, Captain.....	232, 234
Kay, Thomas.....	x, xii
Keefer, T. C., C.E.....	94-5, 167, 201, 221, 260, 315, 319, 322
Kempt, Sir James.....	15
Kennedy, John, C.E.....	289, 294-5, 297, 307, 320, 322 to 324, 326
Kerr, Wm.....	102
Killaly, Hon. H. H., 57, 65, 67, 69, 70, 72, 79, 80-1, 83, 90, 93, 106, 119, 120, 122, 129, 130, 137, 149, 152, 156, 159 to 161, 166-7, 177-8, 183, 197, 206	
Kinnear, David.....	234
Kirkwood, Jas. P.....	263, 265
Lagüeux, L. A.....	6
Lambly, Capt.....	7
Langevin, Sir H. L.....	301, 320
Laurent, Justinian.....	135
Leeming, John.....	234
Letourneux, P. L.....	x, xii
Leslie, Jas.....	1, 3, 8, 13, 14, 18, 19
Leslie, Y. & Co.....	39
Leveille, Jos.....	295
Lindsay, W. B.....	25
Logan, Sir Wm.....	197 to 199, 206, 211
Lord, Lieut.....	72, 124
Lorne, Marquis of, Gov.-Gen.....	302, 310
Lunn, Wm.....	x, xii
Lyman, Henry.....	xi, xiii
McAlpine, W. J., C.E.....	260, 263, 265
McCarthy, Daniel and John.....	137, 328-9
McDonald, Mr., M.P.P.....	153
McDougall, John.....	290
McIntosh & Co.....	39
Mackay.....	295

McKenzie, J. G.....	x, xii
McKenzie, Thos.....	295
McKim, Capt.....	201
McKinn, Robt.....	120, 160, 162
McLennan, John.....	xi, xiii
McLennan, Hugh.....	295, 299
McNee, Mr.....	119, 120
MacNeil, Wm. Gibbs, C.E.....	197-8, 211
Marause, Christian, Pilot.....	234
Marchand, Louis.....	198
Martin, Asa.....	148
Mathieu, P. M., Pilot.....	296
Mayrand, Zephirin, Pilot.....	198
Meldrum, G.....	147-8
Merritt, Mr., M.P.P.....	154
Metcalfe, His Excellency, &c.....	88
Millar, Edmondston, Allan & Co.....	32
Millar, John.....	114, 115, 120
Moffat, Hon. Geo.....	26, 29, 52, 104, 154, 164
Moody, Lieut.....	130
Morin, A. N.....	217, 221
Morton, Capt.....	136
Morton, J.....	96
Murdock, Aitken & Co.....	329
Murray, Earl Cathcart.....	97
Murphy, Edward.....	xi, xiv
Naud, A., Pilot.....	295
Neilson, Mr.....	3
Nelson, Dr.....	x, xii
Nesbitt, J. & J.....	4
Nish, A. G.....	287
O'Brien, Denis.....	147
Ogilvie, W. W.....	xi, xiii
Orlebar, Capt.....	166, 279, 285
Page, John C. E.....	vii
Page, Pierre, Pilot.....	7
Parent, E.....	159, 160, 162, 174
Parker, Wm.....	102
Patterson, W. J.....	288
Penn, Turton.....	x, xii
Petree, Mr.....	182
Piper, Capt. Robt. S.....	x, xii
Porteous, Thos.....	13, 29
Pratt, John.....	xi, xiii
Quesnel, Mr.....	3, 14, 18
Quesnel, F. A.....	101

Raymond, Oliver, Pilot.....	134 to 136
Reyside, Capt.....	75, 85, 116, 119, 142
Redpath, J.....	101, 104, 122, 124, 129
Redpath, Peter.....	xi, xiii
Rendel, J. M.....	71, 73-4, 77, 79, 80, 84, 113, 137, 143-9
Rimmer, Thos.....	xi, xiii
Rivard, S.....	xi, xiv
Robertson, Andrew.....	295, 306, 313, 323-4
Robertson, Geo. R.....	234
Robinson, Mr. M.P.P.....	153, 166, 178
Rodier, C. S.....	x, xii
Rolland, J. B.....	xi, xiv
Ross, Jos. J.....	136
Routh, Sir R. J.....	31, 53
Roy, Adolphe.....	xi, xiii
Rubidge, F. P.....	183, 187, 193 to 195, 201-2
Rudolph, A. M.....	295
Ryan, M. P.....	xi, xiii
Sandom, Capt.....	31, 52
Sax, Mr.....	4
Seymour, Chas.....	234
Scott, H. E.....	102
Shaw, Andrew.....	47
Shehyn, Jos.....	320, 322 to 324
Sherwood, Sol., Gen.....	153
Sippell, John G.....	286
Smith, Atty.-Gen.....	104
Smith, A. S.....	96
Starnes, Hon. H.....	x, xii, xiii
State, Jas.....	147
Stanwood, B.....	286
Stephen, Geo.....	299
Stephens, Young & Co.....	42
Swinburn, Capt.....	136
Tache, E. P.....	195
Thibaudeau, Hon. J. R.....	xi, xiv
Thompson, David, C.E.....	27, 29, 54-5
Tobin & Murison.....	102
Try, John.....	198
Tuck, John.....	148
Vaughan, David, 65 to 68, 70, 75, 85, 92-3, 116, 127, 132, 134-5, 137-8, 142, 147, 152, 157 to 161, 167, 197, 201, 328	
Ward, F. H.....	162
Ward, Brush & Co.....	102

White, Andrew	13
Whitney, H. H.	287, 289
Whitney, H. D.	294, 296-7, 306-7, 313
Williams, J. T.	113, 151-2, 179, 182
Wilson, Frederick A.	164, 193
Wilson, J.	234
Winn, J. H.	xi, xiii
Workman, Wm.	290
Wright, Mr.	194
Yarwood, Stephen.	131, 133, 147
Young, Mr.	18
Young, Hon. John.	104, 109 to 111, 115, 122, 198, 235, 263-4, 286 to 289



LOAN DEPT.

[illegible]

General Library
University of California
Berkeley

YC 68000

47 33 34

